APRIL 25, 1936

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ELECTRICAL WORLD

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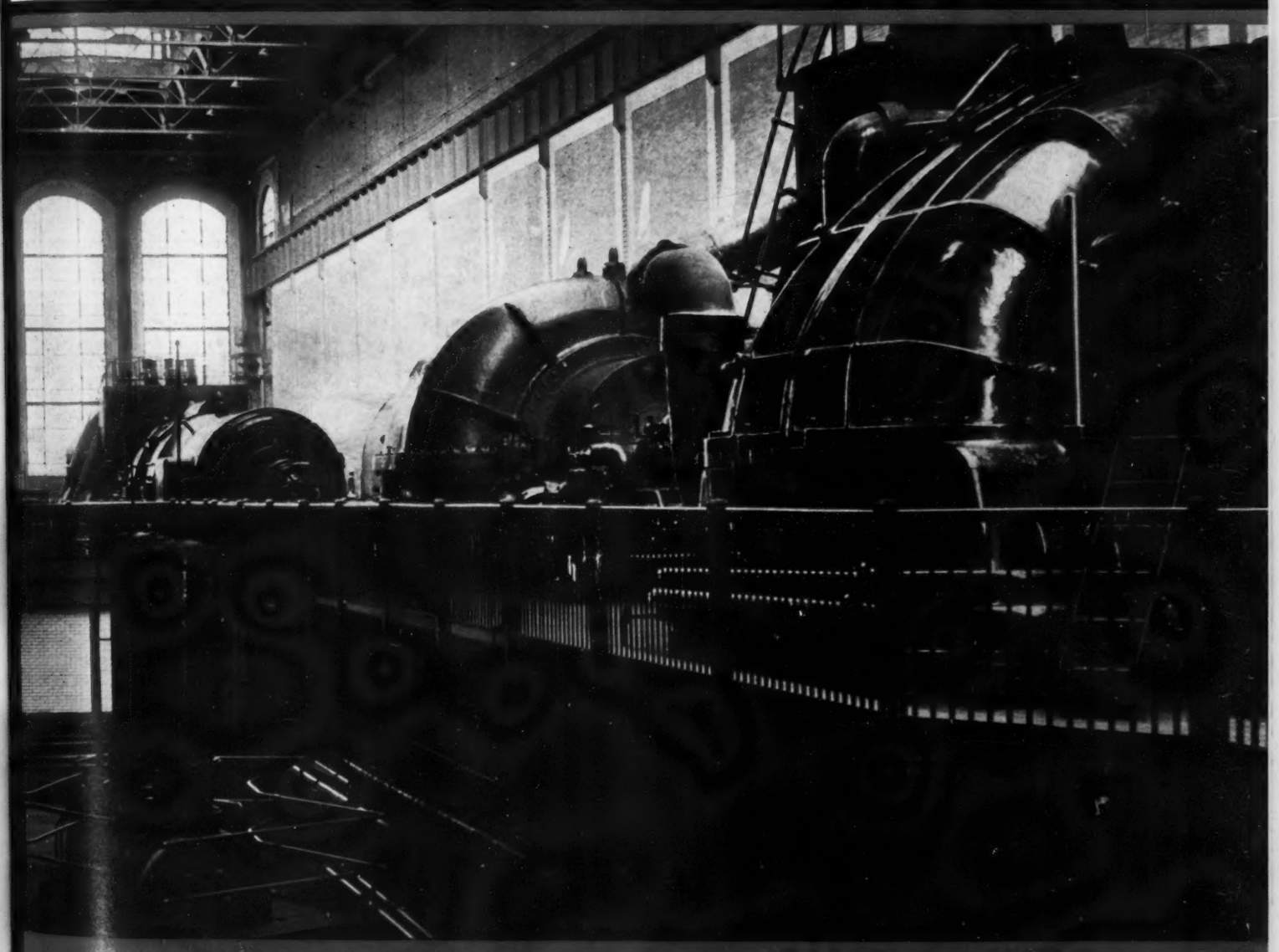

Turbine room of the Cahokia station of the Union Electric Light & Power Company—Delegates to the E.E.I. convention in St. Louis, June 1-4, will have the opportunity to inspect this plant

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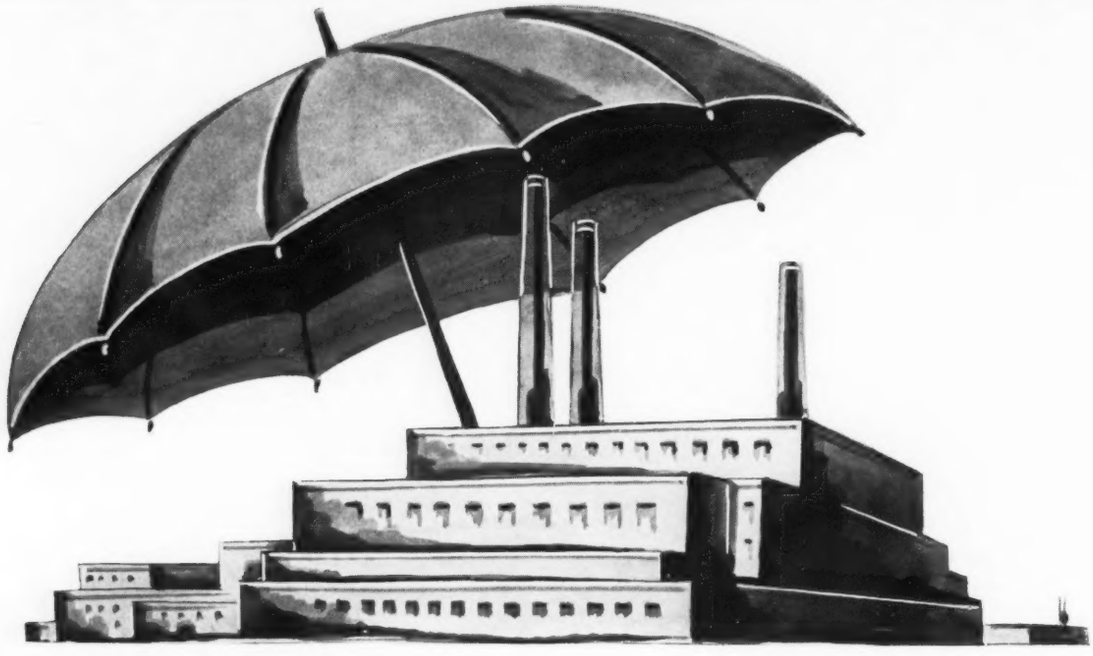
New Deal Effect on Utilities' Stocks

Economics of Rural Line Construction

Senator Pope Talks About Utilities

Prevailing Saturations of Appliances



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Reader's Guide to This Issue

Leaders within the industry and men prominent in public life discuss problems in this issue that are of vital interest to utilities. Articles presented describe the new robot station in Idaho, give interesting statistics on appliance saturation and tell how one company saved by using an overhead secondary network instead of underground. Effect of the New Deal on utility stock prices is shown in still another story. Senator Pope gives his views on utility regulation. Still another article discusses the proper selection and application of materials for rural lines to realize the maximum benefit at the lowest cost.

Of Executive Interest

Prevailing Saturation—Utilities and the National Need—Utility Common Stock Changes—Output Close to 100,000,000,000 Kw.-Hr. —Please, Mr. Lilienthal.

For Power Company Engineers

Fool-Proof Hydro Station—Secondary Network Goes Overhead — Rural Line Economy—Minimum Sag Span on Steep Slope.

On Power Company Sales

Prevailing Saturations — Output Close to 100,000,000,000 Kw.-Hr. —Carter Field on Washington Events—Utilities and the National Need — Laundry Data Sheets.

For Electrical Engineers

Fool-Proof Hydro Plant—Air Bomb Shortens Insulation Test —Wet Conduit Used in Defective Cable Test—Power Data for Conditioned Theater.

For Electrical Manufacturers

Fool-Proof Hydro Plant—Prevailing Saturations — Utilities and the National Need—Rural Line Economy—Secondary Network Goes Overhead.

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100,000,000-Kw.-Hr. Systems Analyzed

Individual statistics on the 1935 production of 175 major utility systems, presented in ELECTRICAL WORLD'S *Annual Supplement* of 100,000,000-kw.-hr. companies, will provide the latest and most reliable information on generator rating, output, customers and distribution of energy, not elsewhere obtainable in similar detail. Accurate figures on output and peak loads of the largest systems in North America will be tabulated for the years 1928 to 1935 inclusive. Figures are presented that support the contentions that the margin of capacity is decreasing and that domestic and industrial energy consumption is increasing.

Sinking Fund for Hydro

R. L. Thomas continues the discussion of hydro depreciation started with his article in ELECTRICAL WORLD of March 14, 1936. Here he gives the reasoning that leads to the inevitable conclusion that straight-line depreciation is totally unsuited to hydro developments and in principle proportionately unsuited to needs of consumer and inventor in other long-life systems.

Bus Protection Gives Service Reliability

Philip Sporn presents the case for differential protection of buses as an economical key to reliable service. This article shows that the supposed obstacles to this type of protection are not serious and that remedies have been found for all of them.

Cooling a Telescope Disk

Dr. G. V. McCauley tells of the kiln design, electrical heating installation and control arrangements used to maintain an annealing temperature of 530 deg. C. for many months in a 200-in. glass telescope disk.

Ford's Steel Mill

Much information on modern industrial plant electrification can be gleaned from this article, which describes the new steel mill of the Ford Motor Company. It presents plenty of ideas to apply to other types of industrial plants.

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MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY SATURDAY

APRIL 25, 1936

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Going Into Action for Business

Current reports on the electrical business are encouraging. Utility output is running about 13 per cent over last year and gross revenue is up about 5 per cent. Electrical manufacturing sales are about 22 per cent over last year. These encouraging records should be improved in the next few weeks because of the spring revival of business activity.

Political capital is made of the generally improved business situation and undoubtedly it is a boon for the Administration. Senator Wheeler, however, attempts to use the increase in some utility stock prices as proof that recent legislation was constructive. He should have used all utility stock prices and should have measured the change in their prices with those occurring in securities of other industries. Also, there is a lag between earnings and stock prices and the financial effect of recent legislation is not yet felt. An analysis shows that actual net earnings reports do not show the gains that were recorded in security prices. Above all, a security price has little to do with any principle involved in deciding whether legislation is fair or unfair.

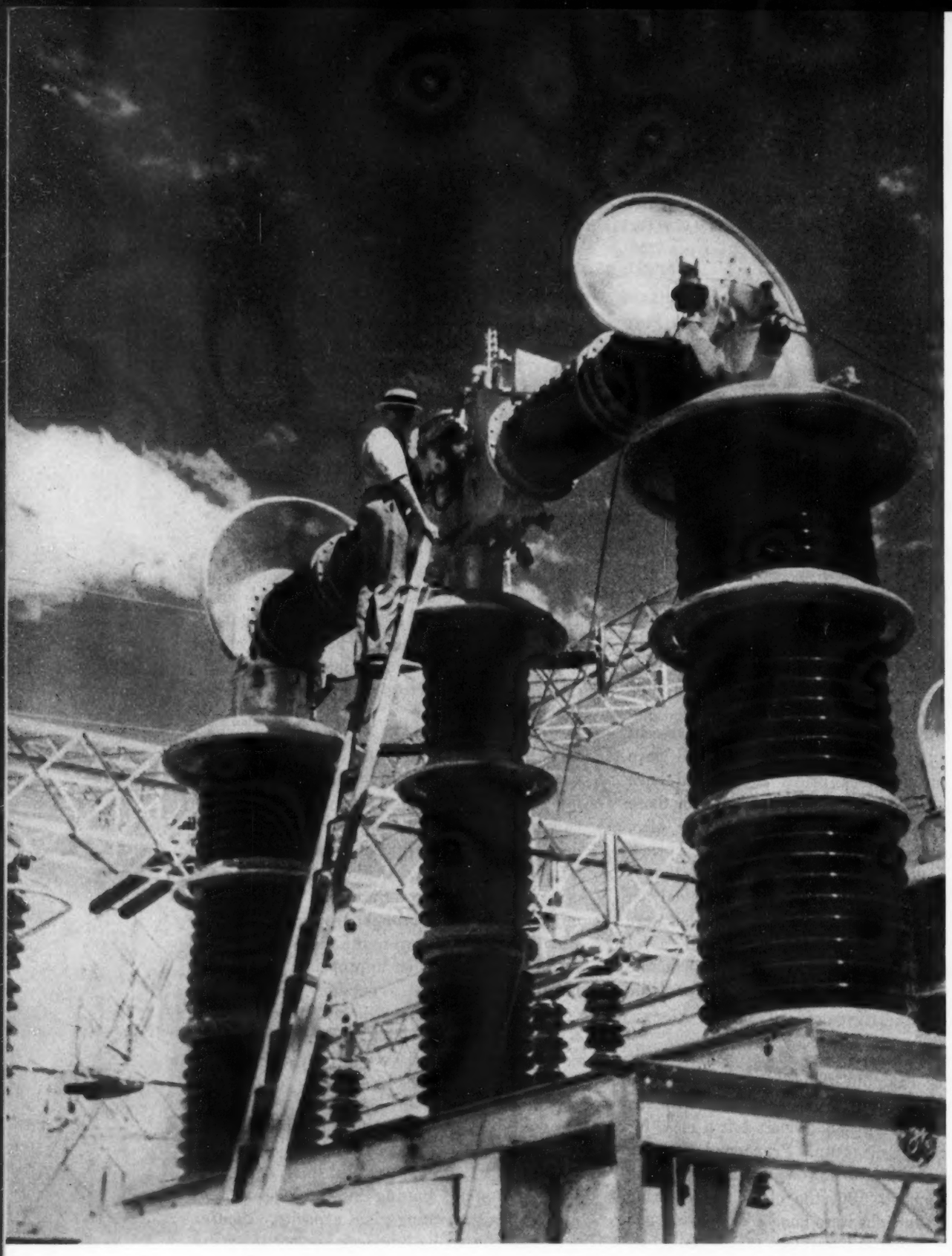
Temporary conditions do not measure basic values. For example, floods and storms put a heavy financial and operating burden on many utilities. Receding flood waters left a mess for utility forces to clean up. Property destruction was not great because of good system design and good equipment. But the cleaning, repairing and drying out jobs were many. Temporary and emergency structures, services and installations had to be built and rebuilt and much revamping of system designs and equipment installations had to be undertaken. Heavy burdens were placed on utilities in stricken areas. But the organizations are now working cheerfully and energetically despite the heavy stresses placed upon their forces by the disasters. Current stock prices do not reflect this kind of loyalty and devotion to public service or the costs that have been incurred.

Some sanity and caution seem to be creeping into Washington. The waves of Fundy dash jubilantly against the rocky Maine coast since the President and Congress appear convinced they were not made for fish ponds or power pools. The Florida ditch is going back to jungle. Hysteria under flood conditions will not result in an enormous pork bill appropriation. The political value of these two projects is found to be zero. We suggest that new bait be chosen to fish in the Congressional pool. For example, sun power from mirrors is a wonderful conception to build up.

Quiet prevails on the legal battle front. Apparently no major utility case will be decided by the Supreme Court before fall. Jockeying continues to bring the holding company law to decision. The government is ahead in its endeavors to make Electric Bond & Share the test case, but utility lawyers are still optimistic that other cases can be brought to decision at least simultaneously. Down in the Carolinas the Buzzard's Roost—what an appropriate name—case is advancing toward a decision in the higher court. In other sections many injunctions and test cases are resting on the dockets of lower courts. Apparently there will be a summer truce in the utility legal warfare.

An open season for construction is bringing an impetus to employment and business. Utilities are at work building rural lines, strengthening distribution, putting in transmission links and adding generating plant capacity. Contractors and consulting engineers report their first busy period in several years and manufacturers record orders and negotiations for all kinds of electrical products. The evidence is unmistakable that the summer will bring a considerable increase in industry activity.

Editor



LARGEST AND FASTEST BREAKERS INSTALLED

Interruption of 2,500,000 kva. in three cycles is the job that the impulse oil circuit breakers for the Boulder Dam-Los Angeles 287.5-kv. line will be called on to do. This is one of the group of breakers located at the Victorville switching station.

Public Utilities and the National Need

A Challenge to Private Utilities to Meet Modern Conditions — Government Ownership Unnecessary — Complete Service at Low Rates Can Be Justified — Limited Federal "Yardsticks" Advocated

By J. P. POPE
U. S. Senator from Idaho

THERE was a time when courts embraced the doctrine of *laissez faire* in its purest form. No power on the part of government to regulate any business was recognized. In England, however, it has been the custom "from time immemorial" to regulate ferries, common carriers, hackmen, bakers, millers, wharfingers, innkeepers, and so on, and in so doing to fix a maximum charge to be made for services rendered, accommodation furnished and articles sold. This regulation became necessary for the public good in theory, and, although modern law has conjured up multitudinous theories on which regulation of utilities can be based, such regulation remains fundamentally predicated on the public good. In modern times jurists justify governmental interference in once private business on the ground that "the business is affected with the public interest." Such affection may be found in the existence of a monopoly on a commodity essential to human welfare, on privileges granted to the utility by the sovereign, or on the wholesale utilization of natural resources. Wholesale abuses and public injury originally brought about regulation of public utilities. The evolution of concepts permitting regulations were thought to solve the problem, but time has marched on.

Again, governments are wondering what should be done about utilities. While it is possible to enforce on public service corporations a legalistic concept of a "reasonable rate," it is impossible to undertake wholesale regulation and supervision of internal management, corporate organization, stock manipulation and profit taking, in order to bring rates down to the levels desirable from a sociological viewpoint.

In the famous case of Missouri ex rel Southwestern Bell Telephone Company vs. Missouri Commission, Mr. Justice Brandeis in a dissenting opinion, concurred in by Mr. Justice Holmes, discussed the theory of rate fixing in the following terms:

> To decide whether a proposed rate is confiscatory, the tribunal must determine both what sum would be earned under it, and whether that sum would be a fair return. The decision involves ordinarily the making of four subsidiary ones:
>
> 1. What the gross earnings from operating the utility under the rate in controversy would be. (A prediction.)
> 2. What the operating expenses and charges, while so operating, would be. (A prediction.)
> 3. The rate base; that is, what the amount is on which a return should be earned. (Under Smyth vs. Ames, an opinion, largely.)
> 4. What rate of return should be deemed fair. (An opinion, largely.)
>
> A decision that a rate is confiscatory (or compensatory) is thus the resultant of four subsidiary determinations. Each of the four involves forming a judgment, as distinguished from ascertaining facts. And as to each factor there is usually room for difference in judgment.

Rate fixing, then, has been a joint function of utilities and government in which neither nor both have been entirely successful. The January, 1935, report of the Federal Power Commission, on average typical residential electricity bills, shows rates varying from $1.41 in California to $2.97 in New Mexico, for 25 kw.-hr. The average throughout the United States is approximately $1.79. For 100 kw.-hr. the variance lies between $3.69 for Washington to $6.44 for Florida. The average throughout the United States is approximately $4.80. For 250

Leaders of opinion outside the electrical industry have been asked to express their views about the utility situation frankly. This is a constructive endeavor to present the views of reputable men who are in a position to observe utility affairs and whose thoughts are pertinent to having the industry go forward. This article by Senator Pope is the first of the series. It is a thoughtful but challenging article by a leading Senator that is written to be constructive from his point of view. Other leaders will discuss the same question from their individual points of view also. These features will give a cross-section of opinion about our industry that should help it solve its problems—EDITORS.

kw.-hr. the resident of Washington pays $6.98, while the resident of New Mexico pays $11.91, and the New Yorker is close on his heels at $11.67. The average throughout the United States is about $9.

If these rates were submitted to a group of utility experts or electrical engineers one would probably obtain varying opinions as to their reasonableness. Such expert advice, however, is not necessary for our purposes. A sad commentary on the reasonableness of American utility rates is self-evident from the fact that 85 per cent of American farms do not have electric service, 70 per cent of American farms do not have radios, 65 per cent do not have telephones, 85 per cent do not have water piped into the farmhouse.

A study of urban electrification would likewise reveal that many families are not now enjoying the advances of modern science, because the cost of these services is not within their means. American farms and homes, it is sometimes said, are behind the times. *I am more inclined to think that American utilities are behind the times.* The United States has been so abundantly endowed with natural resources that every home in the nation should be supplied with electricity. Obviously, all homes, or even a great majority of them, will not be supplied with electricity until its cost is reduced to a point within the means of all consumers. It is fundamental that every consumer will purchase all the utility service he can afford, because it is advantageous to him to do so. It is self-evident that the mountain must come to the utilities in the form of increased purchasing power on the part of prospective consumers, or the utilities must go to the mountain by placing their services within the reach of prospective consumers. Unlike Mohammed's experience, present indications favor a trip to the mountain.

T.V.A. is regulation by competition

In 1933 the United States undertook an experiment in the regulation of public utilities, through the Tennessee Valley Authority. It was simply regulation by the yardstick or competition method. The government itself went into the business of producing and selling electric power. The government, of course, entered the business under a handicap because of the age-old bugaboo that government is notoriously inefficient, and that, due to political interference, bureaucratic red tape and employee indifference, efficiency comparable with that of privately owned and managed businesses could not be attained. Nevertheless, under T.V.A. service in the areas in which it operates rates are from 50 to 60 per cent of what they were before. In June, 1935, it was reported that the Tennessee Power Company, operating in the heart of T.V.A. activities, had just been selected by the Edison Electric Institute as the outstanding company for the year 1934, because it had established "one of the most, if not the most, remarkable sales increases in residential, commercial and industrial power in the history of the electric industry." The record of the private power companies in the three major states in the area of T.V.A. operations leads the entire United States. The actual function of the Tennessee Valley Authority has been, by competition, to force power companies to reduce their rates below the "reasonable rate" heretofore established by public utility regulation. Following is a list of some typical localities served by the Tennessee Valley Authority showing rate reductions and increases in consumption of electric power under the Tennessee Valley Authority:

	No. of Customers Increased	Increase in Consumption	Aver. Residential Customers Consumption Increase	Rate Reduction
	Per Cent			
Alcorn, Miss.	41	243	144	42.55
Amory, Miss.	19	109	76	46.90
Athens, Ala.	44	269	156	45.28
Dayton, Tenn. ..	20	102	68	46.30
New Albany, Miss.	10	133	112	53.16
Okolona, Miss. ..	10	103	84	54.61
Pontotoc, Miss. ..	62	225	101	46.39
Prentiss, Miss. ..	25	154	102	48.73
Pulaski, Tenn. ..	18	169	129	35.88
Tishomingo, Miss.	41	435	279	38.88
Tombigbee Elec. Power Assoc., Miss.	107	290	88	48.68
Tupelo, Miss.	37	270	170	52.09

In each instance increases in consumption have been more than enough to offset losses which may have resulted from rate reduction. I suspect that even the utilities themselves were surprised, but their astonishment only enhances the obvious benefits of the program.

One question which might immediately arise is, what is the effect of all this on the operating utility? Utility executives have been strangely silent as to the "disastrous government competition of T.V.A." during the last few months. A clue as to the cause of this unusual silence might be gained from the following newspaper reports:

On March 5, 1936, the Montgomery, Ala., *Journal* reported:

> The Commonwealth & Southern, most of whose holdings are in the T.V.A. area, made $9,406,000 in 1935, as compared with $7,443,000 in 1934. It was a case of T.V.A. rates encouraging the use of electricity to such an extent as actually to benefit utilities which have heretofore insisted that T.V.A. would be ruinous to utility investors.

On February 12, 1936, the New York *Times* reported:

> Throughout the turbulent conditions in the utility field last year the Commonwealth & Southern group, the principal system affected by the T.V.A., sold $15,000,000 of electrical appliances, a new high record. . . .

On February 6, 1935, the Knoxville, Tenn., *Sentinel* reported a 5 per cent pay increase to employees of the Tennessee Public Service Company.

Challenging conclusions made

Without going into the political arguments for or against government in business, some conclusions are readily obvious. *Utility rates have been too high for the good of the utilities and the consumers alike. Our system of utility regulation is not capable of effectively meeting modern needs. The utilities themselves without direction and regulation have been incapable or unwilling, or both, to meet modern needs.*

Under the guidance of T.V.A. more progress has been made in the Tennessee Valley in the past three years than in the previous decade. On the basis of its success there are proposals pending to create a Mississippi Valley Authority and a Columbia Valley Authority at the present time. Some further legislation undoubtedly will be enacted. One is impelled to question whether the government will eventually take over all public utilities. The tendency is in that direction.

Government ownership not necessary

I believe, however, there is another way out along a pathway quite well defined. During the past two years the Supreme Court has had occasion to act generally on the matter of regulation by the federal government. The Schechter case, involving the National Recovery Act, and the Hoosac Mills case, involving the Agricultural Adjustment Act, largely destroyed whatever aspirations the federal government may have had for the direct regulation of industry. The Tennessee Valley Authority Act case, however,

[*Continued on page 78*]

Utility Common Stock Changes

An Analysis of Quoted Stock Values in American Industry Under the Influence of the New Deal Operations

By ERNEST R. ABRAMS
New York

PERHAPS no nation-wide industry has suffered more from the policies of the present Administration than have the utilities of the country in general and the electric light and power industry specifically. They have been subjected to direct federal competition from federally financed power projects, they have been faced with local competition as the result of federal grants and loans for utility purposes to municipalities, their rate schedules have been attacked by federal bodies, the misdeeds of certain notorious individuals have been attributed without discrimination to the industry as a whole, greatly increased tax impositions have been placed upon them and drastic federal regulation has been imposed upon them by the Public Utility Act of 1935.

An estimate of the full, though varying, effect of the adverse policies of the New Deal is strikingly evidenced by the collective appraisal of the investing public that has been placed upon public utility equities in the past 34 months. In the accompanying table will be found the average prices of the common stocks of the various utility divisions as well as of all utility common stocks and of the common stocks of all United States corporations that are listed on the New York Stock Exchange as at March 1, 1933, or four days before President Roosevelt's inauguration; as at February 1, 1935, or six days before the introduction into the Congress of the "Holding Company Bill"; as at March 1, 1935, or 21 days after such introduction; as at September 1, 1935, or six days after the approval of the Public Utility Act by the President, and as at January 1, 1936.

As at February 1, 1935, or after nearly 23 months of experience with the Roosevelt Administration, the average price of the common stocks of all United States corporations so listed had increased 69.02 per cent over the March 1, 1933, level, while the average price of all utility common stocks had decreased 11.21 per cent. Likewise, as at that date, the common stocks of gas and electric operating companies had declined 39.19 per cent and those of gas and electric holding companies had declined 33.49 per cent from March 1, 1933, prices, while the common stocks of communications companies and miscellaneous utility (traction, omnibus, express, water and central heating) companies had increased 9.41 and 97.27 per cent, respectively.

As at March 1, 1935, or after sufficient time for the investing public to digest the provisions of the Holding Company Bill, a somewhat different picture was presented. The average price of all utility common stocks had declined to 16.93 per cent below March 1, 1933, while the common stocks of all United States corporations were but 60.99 per cent above the March 1, 1933, figure, a decline of 5.72 and 8.03 percentage points, respectively, for the two general classifications. Furthermore, the common stocks of gas and electric operating companies stood 46.68 per cent and those of the gas and electric holding companies stood 44.44 per cent below the March 1, 1933, prices, while miscellaneous utility common stocks were but 80.79 per cent above the figure for

[*Continued on page 115*]

Table I—How Stock Values Changed

Based on data obtained from the Bulletin of the New York Stock Exchange

Class of Common Stocks	Aggregate Quoted Values	Average Prices
March 1, 1933		
Gas and elec. oper. cos.	$1,425,048,788	$22.94
Gas and elec. hold. cos.	695,279,179	8.03
Communications companies	1,995,902,776	57.50
Misc. utility companies	59,957,835	7.71
All utility companies	4,176,182,576	21.85
All United States corp's.	15,961,890,548	13.82
February 1, 1935		
Gas and elec. oper. cos.	870,495,407	13.95
Gas and elec. hold. cos.	454,454,807	5.33
Communications companies	2,186,409,247	62.98
Misc. utility companies	96,088,429	15.21
All utility companies	3,607,447,890	19.40
All United States corp's.	27,236,965,687	23.36
March 1, 1935		
Gas and elec. oper. cos.	762,706,508	12.23
Gas and elec. hold. cos.	379,952,553	4.46
Communications companies	2,198,948,175	63.34
Misc. utility companies	96,880,423	13.93
All utility companies	3,438,487,659	18.15
All United States corp's.	26,608,349,319	22.85
September 1, 1935		
Gas and elec. oper. cos.	1,286,616,247	20.62
Gas and elec. hold. cos.	771,179,613	9.05
Communications companies	2,883,845,706	83.07
Misc. utility companies	150,594,402	19.51
All utility companies	5,902,235,868	26.82
All United States corp's.	33,223,341,037	28.30
January 1, 1936		
Gas and elec. oper. cos.	1,477,741,539	23.68
Gas and elec. hold. cos.	948,747,189	11.14
Communications companies	3,361,473,018	96.83
Misc. utility companies	158,170,118	20.41
All utility companies	5,946,131,864	31.59
All United States corp's.	39,565,809,615	33.47

Table II—Recapitulation of Average Prices of Common Stocks

	March 1, 1933	Feb. 1, 1935	March 1, 1935	Sept. 1, 1935	Jan. 1, 1936
Gas and electric operating cos.	$22.94	$13.95	$12.23	$20.62	$23.68
Gas and electric holding cos.	8.03	5.33	4.46	9.05	11.14
Communications companies	57.50	62.98	63.34	83.07	96.83
Miscellaneous utility cos.	7.71	15.21	13.93	19.51	20.41
All utility companies	21.85	19.40	18.15	26.82	31.59
All United States corp's	13.82	23.36	22.85	28.30	33.47

Secondary Network

Lowered Costs, Simplified Design, Easier Maintenance, Better Operation, Reduced Hazards Are Cited for Aerial Networks

The "as was" condition

The old side-arm construction with several different 2,400-volt, single-phase and three-phase primary circuits, a 550-volt d.c. power circuit, a 230-volt, three-phase power secondary and a 115/230-volt, three-wire lighting secondary as well as a considerable number of foreign wires.

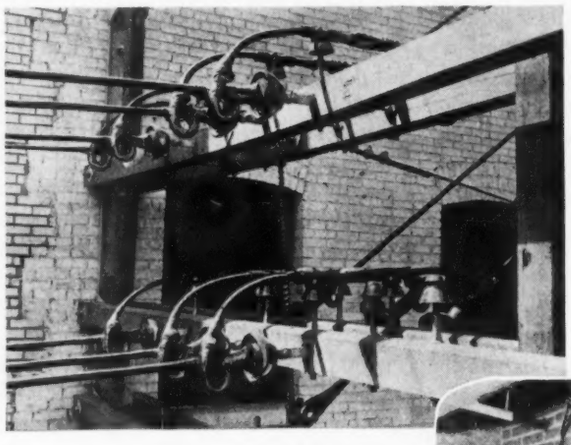
PICTURE a city of some 80,000 population with an obsolete and badly overloaded overhead distribution system in the commercial area, supported on poles and side arms in 16-ft. alleys which are congested with fire escapes and with buildings across the alleys above the first floor at several locations. A glance at the picture of the "as was" condition will reveal what a maze of wires confronted us when we first began our studies of ways and means to modernize this system at Lincoln, Neb. We decided to install a secondary network.

The existing distribution system primary was 4,150 volts (generating potential), 60-cycle, three-phase, four-wire with neutral grounded at the generating station, and therefore this was the logical selection for the new network primary feeders. The load was sufficient to require three feeders initially, in order to provide necessary flexibility and reliability with one feeder out for repairs or construction. For the secondary system 120/208 volts, three-phase, four-wire was chosen.

Not being able to take advantage of any existing duct and manhole system, for there was none, we first prepared several estimates covering a complete new underground system. The obvious advantages to be realized in appearance and maintenance alone by clearing the alleys of all overhead wires made this look very attractive, but we had not progressed very far before we were rudely awakened from our dreams by a few hard facts that arose from a study of sub-surface conditions in the alleys. Aside from telephone ducts, water pipes, gas pipes and steam heat mains, we also found a surprising variety of storm and sanitary sewers at the street intersections. Some of these were so large and the space above them so congested that we would have been forced to pass under them with our ducts at a depth approaching that of a mining operation.

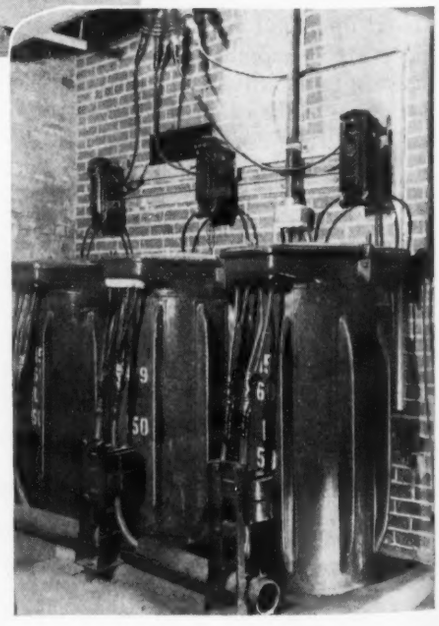
Another factor which contributed materially to the very high estimate for an underground system was the cost of running service conduits and cables, although in some later estimates we reduced this by figuring risers in the rear of the buildings and distributing a number of services overhead from these points. Nevertheless, the total estimated cost was entirely too high to be justified by economic factors and consequently our thought naturally turned back to an aerial system.

The expected savings to be realized became apparent at once. We could eliminate all expensive duct and manhole construction, as well as large transformer vaults. The cost of the transformers themselves could be reduced to about two-thirds of the previous figure, for now we could use standard distribution type units and, best of all, we had a considerable number already on hand which were of a size suitable for the job.



Holding the primaries

Primary dead-end showing insulated cable and method used to attach crossarms to buildings. Primary conductors are rubber insulated for 5,000 volts, due to narrow alleys with fire escape projections. Note that snubbing type dead-end clamps are used and that 100 per cent insulation is maintained by taping over all. A single neutral common to both circuits is shown on the white insulator at upper left position.



Service vault converted to network

Three 50-kva. standard distribution type transformers installed in basement vault. Note cutout boxes for disconnecting and pothead terminal on incoming primary cable from alley pole.

Goes Overhead

By R. O. SUTHERLAND
United Light & Power Engineering and Construction Company, Kansas City, Mo.

In the winter time the annual peak load occurs during the late afternoon period, due to the overlapping of the commercial lighting and power loads, and the low ambient temperatures prevailing allow us to load these units considerably above normal, so that a high average capacity factor can be realized eventually.

Loads in the network area range from 80 kva. per block to 550 kva. per block, averaging about 250 kva. On a square-mile basis these figures would be equivalent to a load density of from 16,000 to 100,000 kva., with an average of 43,500 kva.

The total installed transformer capacity is 4,725 kva. and the maximum demand so far recorded at the station bus is 2,376 kva., or a capacity factor of 50.2 per cent.

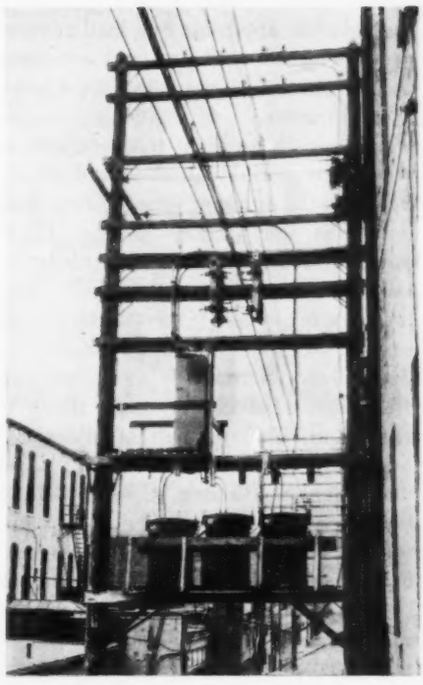
Completed costs on the job ranged from $34.50 per kva. of capacity to $36.20 per kva. for the different sections of the area. For an equivalent underground network these costs would have been from 50 to 80 per cent higher per kva., depending upon a great many factors, so that the economy of the aerial type of system is quite apparent.

Operating records over a year's time seem to prove that voltage regulation has been vastly improved, for now the voltage charts which are taken in the network area show a close approach to the much-desired "perfect circle." The performance record of cables and equipment has been perfect so far. Just recently a very thorough inspection was made of the entire system and everything was found to be in 100 per cent condition. Examination of the cables at each cable ring failed to show any evidence of ring cutting, so that we have high hopes of a long and successful service record for this job in Lincoln.

The primary feeders consist of No. 4/0 stranded copper conductors with 5,000-volt rubber insulation protected by two weatherproof braids and mounted individually on the usual porcelain insulators. This high insulation was decided upon purely as a safety measure against accidental contacts due to proximity of fire escapes in these narrow alleys.

Wood-pole "H"-frame type of construction was used in order that primary and secondary conductors could be located over the middle of the alley for maximum clearance from buildings, etc. Each primary feeder is individually regulated at the station by single-phase, induction regulators set for high-resistance and low-reactance compensation to give correct overcompounding without hunting and without mechanical interconnection.

We did not seriously consider for

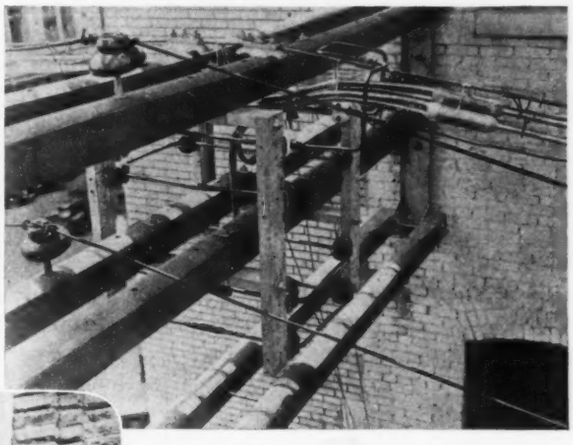


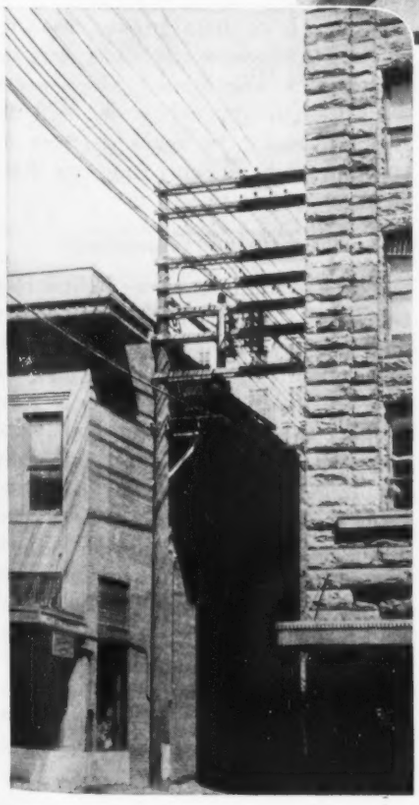
Instead of the network vault

A typical transformer and network protector installation. The steel cabinet above the transformer contains a standard indoor type network protector. The cables from the transformer enter the cabinet at the bottom and leave at the top to supply the secondary mains. An extra set of cables can be observed leaving from the top to enter a service pipe to one of the buildings. Overhead service drops can be seen leaving all four corners of the open service bus above the protector. Primary leads to the transformer drop vertically at the right of the structure.

A service center

We first developed small service boxes for aerial mounting which contained short buses with lugs for service connection. These were compact but rather expensive, so the final plan adopted was to use insulated open buses mounted on heavy porcelain supports on a channel iron frame forming a hollow square. Service connections were thus available from all four corners where the drops terminated. Note secondary joints and manner in which messenger cable is carried over the arm.





And the "as is" condition

The new "H" frame construction showing foreign wires on first two arms from the top. The next two arms support two three-phase, four-wire, 4,150-volt No. 4/0 network primary circuits. Secondary cables and messenger are shown on next two lower arms and bottom arm is for walkway. The small cable and messenger is a short telegraph cable extension from the Western Union office. All telephone cables are underground.

secondaries anything but lead-covered cable with about 2 per cent antimony in the sheath as a protection against crystallization. A disturbing factor was the high ambient temperatures to which the aerial cables would be exposed in the summer time. These temperatures may reach 50 deg. C. or more, and consequently the insulation must withstand a much higher final temperature than on underground service for the same temperature rise due to load current. With rubber thus eliminated, the choice came down to varnished cambric with an allowable final temperature of 75 deg. C., paper insulation at 85 deg. C. and "Rockbestos" at 100 deg. C. The latter cable was selected for two principal reasons: First, it provided an allowable temperature rise of 50 deg. C. from 50 deg. ambient temperature, and, second, it permitted the use of a small enough conductor to insure burn-off under fault conditions and yet carry the load current desired. No. 2/0 stranded copper was the size chosen, having a 0.093 inch wall of Rockbestos insulation and 6/64-in. lead sheath, made up single conductor.

This cable has a current-carrying capacity of 362 amp. at 40 deg. C. ambient temperature without exceeding the allowable final temperature of 100 deg. C. In fact, the only limit of temperature rise seems to be the melting point of the lead sheath, although voltage regulation would fix the practical limit. Calculation showed that 710 amp. could be carried without damage.

Tests on secondary cables

Due to the lack of experimental and operating data on burn-off characteristics of these cables suspended in air, exhaustive tests were run by the manufacturer on set-ups duplicating field conditions. All manner of faults were tested, both phase-to-ground and solid phase-to-phase short circuits. The phase-to-ground fault cleared very quickly without burning back the lead sheath. The phase-to-phase faults also cleared, but not so quickly, of course, and not without some fusing of the conductor, although no damage occurred to the messenger cable in any of the tests.

Joints and taps were made up in the conventional manner using lead wiping sleeves. The tape used was a special asbestos type and dehydrated asbestos rope was used as a filler. Sealing of the cable ends at the network protectors and service racks presented a rather difficult problem. Standard potheads proved too costly, so a unique terminal was developed consisting of a thin-wall drawn copper shell, 4 in. long, sweated on the end of the conductor as insurance against moisture following the conductor strands up into the insulation, which is possible if plain soldered conductor terminals are used. A heavy covering of high-grade rubber tape, overlapping the sleeve and the lead sheath, was first put on and then several layers of friction tape to protect the rubber, after which the tape was given a coat of weatherproof paint. Periodic painting will maintain these cable ends in good condition.

Secondary networks apparently are like Pullman berths —the higher the lower and, contrariwise, the lower the higher. By constructing the system in the higher position the cost is much lower. Completed cost, about $35 per kva. of capacity. For undergroupd the cost would have been from 50 to 80 per cent higher.

Messenger cable

The next problem was how to support these cables in the air, and one of the first decisions made as a step toward economy and simplification was to use the messenger cable for the secondary neutral of the system, thus doubling up on the electrical and mechanical requirements of this one item. We wanted conductivity equivalent to the phase conductor or No. 2/0 copper and yet high enough mechanical strength to support the three single-conductor cables under Class A or heavy loading conditions. A composite seven-strand "Copperweld"-copper cable 0.534 in. diameter was chosen, having an ultimate strength of 17,600 lb. and with a resistance of 0.081 ohm per 1,000 feet. This cable consists of four strands of high-strength Copperweld wires and three strands of hard-drawn solid copper wires for conductivity.

Many types of cable rings were studied and it was found that if we bunched all three single-conductor cables in one large cable ring there would be some danger of ring cutting on the lower two cables due to the concentration of pressure on the cable sheaths. Therefore, it was decided to support two of the cables side by side in large cable rings and the third cable in smaller rings suspended inside the large rings. The large rings were made up of Copperweld in order to avoid any possibility of galvanic action with the messenger cable due to the joint formed between dissimilar metals, and the small ring was made of "Calsum" bronze, which is non-magnetic as well as non-galvanic with the messenger.

Mechanical problems incidental to dead-ending the messenger were often exceedingly difficult. "H"-frame construction was used throughout, the upper cross-members supporting the No. 4/0 rubber-insulated 4,150-volt primary feeders and the messenger suspended directly over the middle of the alley from a lower arm.

Fir cross-members were used, $4\frac{3}{4}$x$5\frac{3}{4}$ in. in cross-section and doubled for strength, with standard double-arming bolts at intervals for rigidity. They did not possess sufficient strength, however, to withstand the 8,800 lb. ultimate tension in the messenger and it was necessary to transfer this load to down guys and anchors. This was accomplished by making up heavy forged steel rings on which to terminate the messenger, and then a "Y" was made from these rings to each side of the alley, where guy stubs were set with heavy anchorage. Copperweld high-strength guy cable was used entirely in order to avoid decrease in strength due to corrosion as time went on.

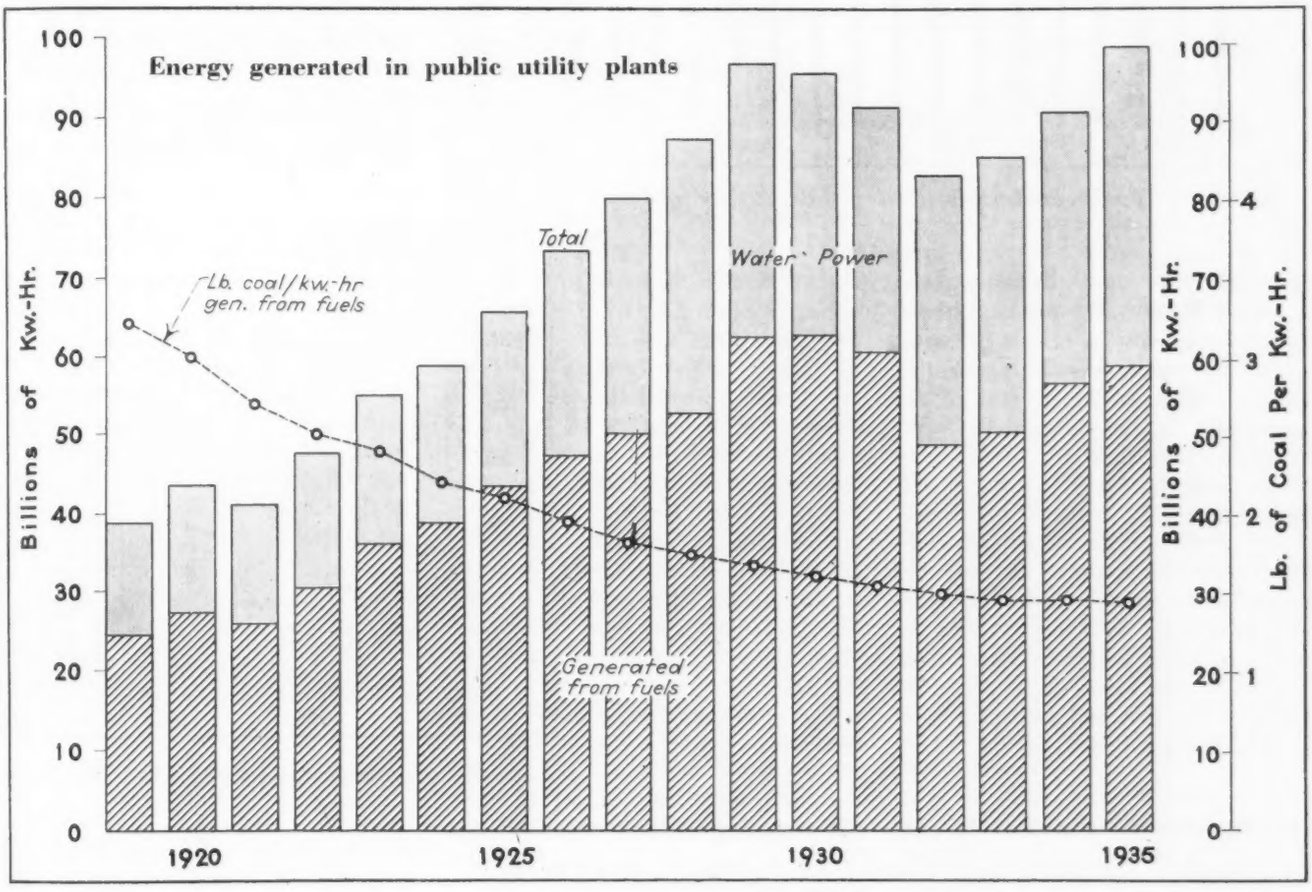
Transformer mountings

Elevated platforms were built across the alleys to support the transformers and network protectors. The latter are standard open type units inclosed in steel cabinets with brass wiping nipples extending out on both sides near the top from a short bus, thus enabling us to loop the secondary cable through the cabinet if necessary, and by wiping the cable sheaths to these nipples a weatherproof job was obtained. Since the capacity of the transformer banks ranged from 150 to 450 kva., protector ratings of 600, 800 and 1,200 amp. were used. Open type units are used in all but one of the basement transformer vaults that were

[*Continued on 115*]

Output in 1935 Close to 100,000,000,000 Kw.-Hr.

Production of 99,397,527,000 Kw.-Hr. and Year-End Capacity of 36,133,112 Kw. Set New Record for Public Utility Plants



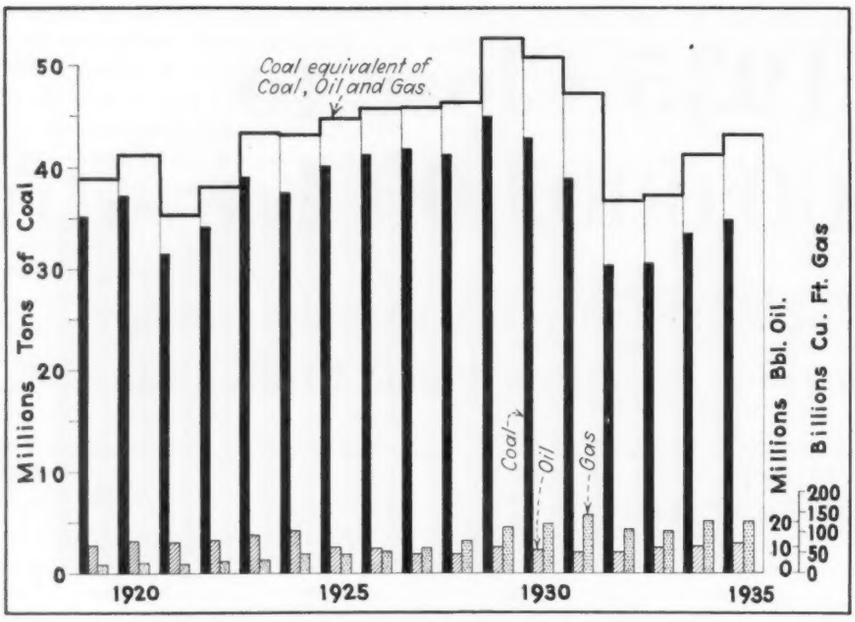
Output has resumed the rising trend interrupted nearly six years ago. Water power has held its place through the years. Coal consumption is no greater than it was in 1919, although the output of thermal plants has greatly increased.

FOR half a dozen years the attainment of an annual kilowatt-hour output running into twelve figures has been viewed as a new milestone in the electrification of America. In 1929 the hundred-billion mark was missed by less than 3 per cent. The depression years brought a decrease, with the minimum in 1932, followed by a rise. Final figures for 1935 recently announced in the U. S. Geological Survey's annual summary of operations of public utility plants give the output as 99,397,527,000 kw.-hr., only 0.6 per cent short of the mark and constituting a new all-time record, 9 per cent above the amount in 1934 and nearly 20 per cent above 1932.

By a small margin the installed capacity, 36,133,112 kw., also sets a new record. The previous year-end maximum was 36,060,593 kw. in 1932. For two years thereafter retirements exceeded new installations. The net increase during 1935 was about a quarter million kilowatts.

As is evident from one of the accompanying tables, central stations have 94 per cent of the total capacity and produce an equal fraction of the total output.

A little more than 1 per cent is contributed by that part of the energy produced by manufacturing plants which is sold. For comparison, a corresponding table is reproduced from



Fuel consumption in public utility plants

Capacity of Plants, by Types of Prime Movers

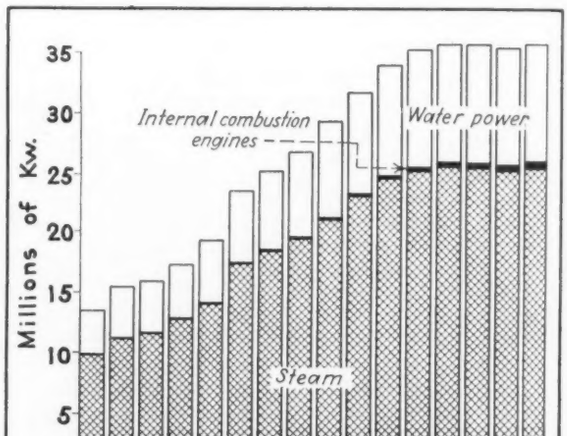
Prime Movers	Water Power (kw.)	Steam Power (kw.)	Internal Combus'n (kw.)
One type.....	9,587,506	25,162,222	459,473
Combination....	266,302	545,987	111,622
Totals.....	9,853,808	25,708,209	571,095
Total capacity, end of 1935.....			36,133,112

the report for the preceding year.

Although only 27.3 per cent of the installed capacity is driven by water power, the output from this source of energy rose to 40.2 per cent of the aggregate. In the light of the ever-increasing efficiency of fuel-burning plants and the large capital investments generally required for water-power plants and the associated transmission lines, it might be assumed that hydro plants would decrease in relative importance. This has not been the case. In 1920 the ratio was almost identically the same, 27.1 per cent. Statistics for that and for subsequent years were published in the ELECTRICAL WORLD of January 4, 1936, on page 67. They are given also in the survey report and are here presented in the form of a chart entitled "Capacity of Generators in Public Utility Plants." Similarly, the output ratio has shown no tendency to decline. It ran up to 41.0 per cent in 1932 and was down to 33.4 per cent in 1931.

The most pronounced increase occurred in capacity driven by internal combustion engines. This now constitutes 1.6 per cent of the total. It increased by nearly 9 per cent during the year and has approximately doubled in the past seven years.

Remarkable also is the effect of improvements in the utilization of fuel.



Capacity of generators in public utility plants

Number, Capacity and Output of Public Utility Plants, 1935 and 1934

Type of Plants End of 1935	Companies No.	Plants No.	Capacity Kw.	Capacity Per Cent	Total Output Kw.-Hr.	Total Output Per Cent
Central stations	1,526	3,708	34,016,179	94.13	93,655,864,000	94.22
Electric railways	22	27	1,080,570	3.00	2,291,793,000	2.31
Electric railroads	6	7	310,760	0.86	638,221,000	0.64
Bureau of Reclamation	4	11	37,977	0.11	155,658,000	0.15
Public works	19	27	429,972	1.19	1,315,624,000	1.32
Manufacturing	62	70	257,654†	0.71	1,340,367,000	1.36
Totals	1,639*	3,850	36,133,112	100.00	99,397,527,000	100.00
End of 1934						
Central stations	1,500	3,697	33,932,639	94.58	85,970,402,000	94.30
Electric railways	21	31	1,071,145	2.99	2,275,774,000	2.50
Electric railroads	6	7	154,160	0.43	617,230,000	0.68
Bureau of Reclamation	4	11	37,977	0.11	151,546,000	0.17
Public works	13	21	401,030	1.12	967,485,000	1.06
Manufacturing	62	70	276,874†	0.77	1,168,439,000	1.29
Totals	1,606*	3,837	35,873,825	100.00	91,150,476,000	100.00

*Includes 80 duplications in 1935 and 90 in 1934 due to companies operating in more than one state.
†Adjusted on basis of output sold.

The consumption of 11,393,000 bbl. of fuel oil, 125,239,000,000 cu.ft. of gas and 34,807,000 tons of coal was equivalent to 43,188,000 tons, or 1.46 lb. of coal per kilowatt-hour of energy thus produced. This is 45 per cent of the rate in 1919. Consequently, while energy production is now 147 per cent greater than it was in that year, the coal-equivalent is only 11 per cent greater.

In addition to the items here discussed the report, which was compiled by the Division of Power Resources of the U. S. Geological Survey, contains a table similar to that in the ELECTRICAL WORLD of January 4, 1936, on page 66 and detailed statistics by months and by states on energy output and on the consumption of various kinds of fuel.

Please, Mr. Lilienthal!

The above is the heading of an article in "Snap Shots," the organ of the Georgia Power Company, March issue, which answers many of the much-publicized claims of the T.V.A. in affecting utility practices. We reprint an abstract of the article because of the nation-wide interest in the situation

"THROUGH the kind efforts of David E. Lilienthal, member of the board of directors of the Tennessee Valley Authority, the Georgia Power Company has recently been receiving extensive and highly favorable publicity throughout the United States. *Snap Shots* is most grateful to Mr. Lilienthal for spreading far and wide the story of our company's progressiveness, and we do thank him.

"It came about in this way. A couple of months ago Mr. Lilienthal made an address in New York in which he quoted statistics compiled by ELECTRICAL WORLD to the effect that the Georgia Power Company is outstanding among all electric companies in the United States—a leader in the lowness of electric rates, a leader in the selling of electric appliances and a leader in practical accomplishment, as measured by the abundant use of electric service in homes throughout Georgia.

Attracts widespread attention

"In addition to widely published news accounts, Mr. Lilienthal's address and his flattering references to our company were made the basis for an editorial printed in Scripps-Howard newspapers all over the country. Because this editorial appeared at just about the time the T.V.A. decision was announced by the Supreme Court, it aroused more than ordinary interest and was reprinted by many other newspapers, including some in Georgia.

"The information used by Mr. Lilienthal is not new to employees and customers of the Georgia Power Company. Georgia has the highest average residential electric consumption of any state east of the Rocky Mountains. In 1934 our company led all electric companies in the United States in sales of electric refrigerators and water heaters, and was second in sales of electric ranges, even though we ranked only twenty-third in total number of residential customers.

"But there's one thing we don't especially care for. Mr. Lilienthal not very delicately implied that he is responsible for our extraordinarily good record. In fact, he almost came right out and said so. The Chattanooga *News*, for example, reported: 'From the sales records of private utilities in the Tennessee Valley, including the Tennessee Electric Power Company, the Alabama Power Company and the Georgia Power Company, Mr. Lilienthal took figures to show how the lowered rates, made through T.V.A. agreement, had boosted sales of appliances and current.'

"Again, the New York *World-Telegram*, in its widely reprinted editorial: 'Companies and regulating commissions have been afraid to trust the theory that reduced (electric) rates will increase business and net income. T.V.A. proved it would work.'

"The eminent Walter Lippmann summed up the matter in his column when he said: 'The claim of T.V.A. is . . . that it is teaching them how to sell.'

"As applied to the Georgia Power Company, we deny the pertinent statements in those quotations. Our low rates are not low because of any agreement with the T.V.A. The theory that low rates will stimulate business is not an offspring of Mr. Lilienthal's brain. We had heard of it before and had been trusting it with almost child-like faith. And the T.V.A. is not teaching this company how to sell.

"If we understand Mr. Lilienthal, his attitude is that the George Power Company, among others, was just an old fogy until he came to Knoxville. This bland assumption of superiority on the part of a young fellow just starting out in the business might be irritating if it wasn't so amusing.

"Long before the T.V.A. was ever imagined, our company was practicing aggressive salesmanship of electricity and electric appliances and offering promotional rates to stimulate the use of both. Our company has had an enterprising sales policy for fifteen years or thereabouts, and would have had one sooner if there had been anything much to sell in the way of electric appliances.

"It must be kept in mind that the electric refrigerator, range, water heater and others are comparatively recent inventions. Our company began advertising and selling them practically as soon as they became commercially salable—that is, when they were made low enough in price and efficient enough in operation for us to recommend them to our customers.

Georgia Power pioneered in promotional rates

"Even in that dim, distant pioneering day low rates of the promotional type were being offered. Those rates and sales policies were being applied successfully when Mr. Lilienthal was just fresh out of college.

"Still lower and more highly promotional rates were made available to our customers in January, 1929. At that time the T.V.A. was hardly more than a gleam in the eye of its father, Senator Norris.

"The 1929 rates, in spite of their unpopular service charge, nevertheless sharply reduced the cost of service to thousands of customers and established a uniform low rate structure throughout the company's territory, including the very small towns which had previously had very high rates. It was a rate designed to accomplish just exactly what Mr. Lilienthal claims he began to teach us five years later. It got results.

"Our customers were enjoying rates well below the national average, and residential consumption was considerably above the national average, even back in 1929, when we had no T.V.A. to teach us.

"Mr. Lilienthal graciously compliments our appliance sales record of 1934, amounting to $2,579,142, but fails to mention the fact that sales

[*Continued on page 131*]

Twin Falls plant of the Idaho Power Company, nestled 200 ft. below the rim of Snake River gorge. Arch dam at upper left is free to deflect under changing heads and temperatures. Power house, at left of station yard, is submerged at high-water level

Fool-Proof

Robot Station Located in State of Idaho Controlled by One Operator 4 Miles Away

NINE MILES northeast of the city of Twin Falls, Idaho, 200 ft. below the rim of the 500-ft. rock canyon of the Snake River, lies the Twin Falls power plant of the Idaho Power Company. Recently completed, it is the fifth development of the company on Snake River in Idaho.

Sealed against flood, and remotely controlled from the Shoshone Falls plant, 4 miles downstream, the hydroelectric development is rated 9,375 kva., under a present head of 147 ft. With Snake River highly regulated above Twin Falls, the Twin Falls project carries but a small pondage, the dams forming a small 1,000-acre-ft. lake, available for daily regulation to supplement stream flow.

Built on lava

Geologically, the site is principally a built-up plain of lava sheets, deeply dissected by the Snake River canyon. At Twin Falls a sheet of lava at least 1,000 ft. wide and of unknown depth lies athwart the canyon bottom, 400 ft. below the canyon rim. The natural falls are 130 ft. high. An island of solid rock, its lower extremity at the falls, divides the stream bed into two channels, thus creating the two falls, from which the location derives its name. On the right, to the north, is the principal channel.

Development comprised seven units: Construction of an arch dam in the north channel, gravity dam and headworks of the power house in the south channel, penstock tunnel, retaining wall and yard fill for substation, power house and substation, tailrace, and road into the canyon.

The north channel dam is 14 ft. 6 in. high and 510 ft. long, measured along the arch, of which the radius to the down-stream face is 225 ft. Unique feature of this dam is the sliding joint with its base. Separated with a sheet of tar paper, the arch is free to adjust itself to load and temperature changes. Movements of $\frac{1}{3}$ in. have been measured. Flashboards, 3 ft. 5 in. high, raise the dam height to 17 ft. 11 in., and are supported by pipes designed to give way and release the flashboards when water level reaches a predetermined height.

Mass concrete forms the south-channel dam, which is of the gravity type, 28 ft. high, 200 ft. long and which includes the intake of a 10-ft.-square opening.

Excavated through the rock cliff adjacent to the power house is the penstock tunnel. On a slope of 60 deg., the tunnel is 10 ft. in diameter, 206.51 ft. long and lined with welded steel pipe for a distance of 180.5 ft. from its lower end.

Only tailrace side exposed

The power house and substation yard are situated at the south edge of a deep pool below the south falls, in an alcove surrounded with lava cliffs 200 ft. high. The yard level is at the high-water mark.

Rising only 3 ft. above yard level, the power house proper is of reinforced concrete. A stair well is provided for entry and an 18-ft.-square hatchway in the floor for the handling of station equipment. Gantry crane and transformer are located in the station yard. Only the tailrace side of the power house is exposed.

Generating unit, control board cubicle, pumps and compressor, governor, air washer and auxiliary equipment are located on the main and basement floors of the station, which is square. The machine is a complete generating unit, having its own direct-connected exciter, separate station service transformer and bus layout.

Double-rated unit

At 13,500 kw., the General Electric vertical waterwheel-driven generator is rated: Unity power factor, 240 r.p.m., 6,900 volts, three phase, 60 cycles, with direct-connected 75-kw., 125-volt d.c. main exciter and 3-kw., 125-volt d.c. pilot exciter. It is also rated at 9,375 kva., 0.9 power factor, based on 60-deg. C. temperature rise with 70-deg. F. cooling water. The generator is self-ventilating.

The turbine is an Allis-Chalmers vertical shaft, single runner, wicket gate, rated capacity 13,300 hp. at 240 r.p.m. under a 142-ft. head. Generator

Hydro Plant

Dam Adjusts Itself to Head and Temperature — Construction Is Proof Against Floods

rotor, hydraulic equipment and thrust amount to 100 tons, carried by a 41-in., water-cooled Kingsbury thrust bearing.

Included in the design of the Twin Falls plant is provision for changing the height of the dams to provide 179 ft. of head, thus increasing the generating capacity to 13,500 kva. This head will be carried by the turbine.

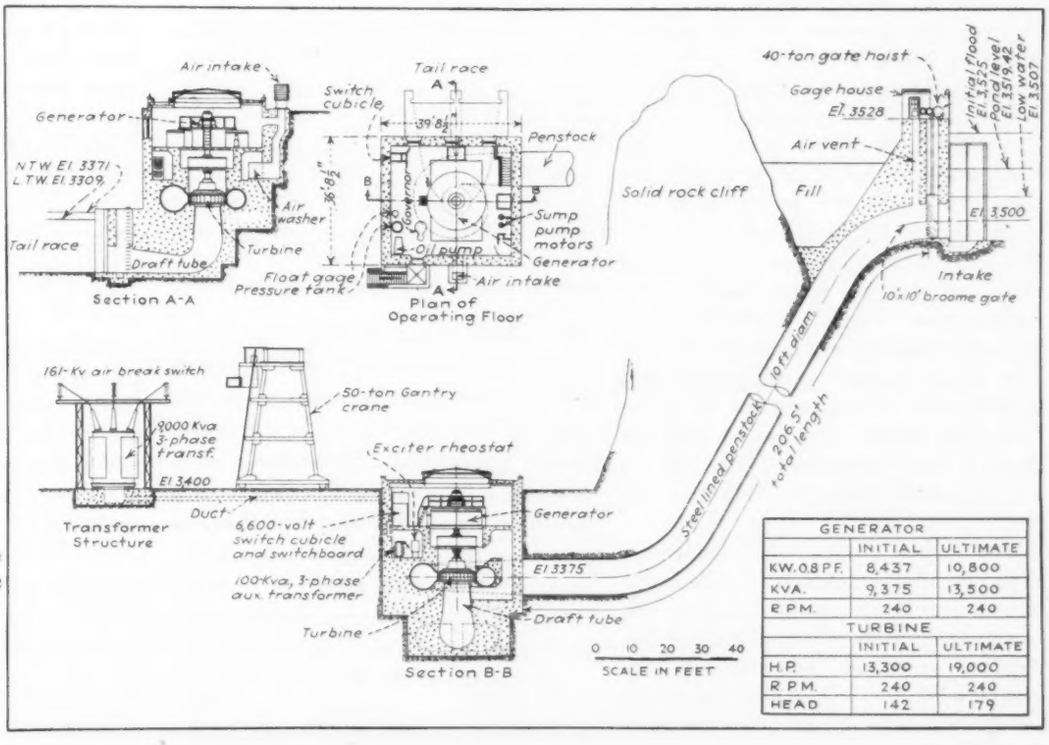
The main transformer is a Westinghouse 9,000-kva., three-phase, 60-cycle, outdoor type, self-cooled, 138,000 to 6,600 volts. It is connected "Y" on the high-tension side and delta on the low. The high-tension neutral is grounded through a 50/5-amp., 15,000-volt outdoor current transformer.

At the Shoshone Falls plant, 4 miles downstream, one operator is warned of any necessity for attention to the Twin Falls station by a complete alarm system. He can determine the elevation of the storage pond at Twin Falls, turbine gate opening, kilowatt-hour output, hourly kilowatt peak and may open the oil switch and close the turbine gates. Any unbalancing of phase currents due to faults will cause all equipment to be opened at once and the machine to be completely cleared from the line. Connection between plants for this purpose is through a six-pair, lead-covered cable, 25,000 ft. long.

Built in eight months

Despite inaccessibility, which required blasting a half-mile roadway out of the solid rock wall of the canyon, the Twin Falls plant was completed in but slightly more than eight months. Hiring of labor from local communities provided substantial aid to the then prevailing unemployment situation.

Located in a portion of the Snake River canyon recognized for its picturesque and rugged beauty, the Twin Falls plant was designed for maximum preservation of scenic qualities. For the enjoyment of visitors, trees, grass and shrubs will be planted to harmonize with natural surroundings.



GENERATOR		
	INITIAL	ULTIMATE
KW. 0.8 P.F.	8,437	10,800
KVA.	9,375	13,500
R.P.M.	240	240
TURBINE		
	INITIAL	ULTIMATE
H.P.	13,300	19,000
R.P.M.	240	240
HEAD	142	179

Plan and elevation of the Twin Falls hydro-electric generating station

Prevailing Saturations

Some Interesting Statistics on the Extent to Which the Major Household Appliances Are in Use on the Lines of 90 Power Companies

AN INTERESTING reflection of the prevailing saturations which have been achieved on the more prominent power systems throughout the country has been revealed by data just submitted by 90 companies. These data, in so far as they covered the merchandising activities of the industry for the year 1935, were published in ELECTRICAL WORLD on March 14. The reports on saturation, however, were held out for separate treatment and are here presented.

These 90 companies have a total of 12,373,131 domestic meters connected. Seventy-seven of them are actively merchandising and thirteen sell no appliances themselves. Of these 77 companies that merchandise, 72 know their saturation on refrigerators, 69 on ranges, 45 on water heaters, 37 on clothes washers, 34 on ironing machines and 35 on vacuum cleaners. Of the thirteen companies which do not merchandise, twelve know the saturation on refrigerators, ten on ranges, seven on water heaters, six on clothes washers, seven on ironing machines and six on vacuum cleaners.

And in those cases where the utility does not know what major appliances their customers are using there are some curious combinations. One company reported on ranges and nothing else and one on water heaters and nothing else. Four reported on ranges and water heaters and nothing else and four on refrigerators and ranges and nothing else. Three reported on ranges and water heaters, but not on refrigerators. Two companies reported on washers and cleaners and not on ironers.

The highest saturations reported by those companies that sell appliances were. Refrigerators 55, ranges 46, water heaters 20, clothes washers 85, ironing machines 16 and vacuum cleaners 90 per cent, while the lowest by these companies were: Refrigerators 14, ranges 1, water heaters 1, washers 10, ironers 1 and cleaners 15 per cent. The highest saturations reported by the non-merchandising companies were: Refrigerators 60, ranges 42, water heaters 11, clothes washers 70, ironing machines 10 and vacuum cleaners 70 per cent, while the lowest were: Refrigerators 28, ranges 1, water heaters 1, washers 18, ironers 1 and cleaners 60 per cent.

Average saturations

The average saturations of the 77 companies that merchandise is: Refrigerators 32, ranges 11, water heaters 4, clothes washers 55, ironing machines 5 and vacuum cleaners 60 per cent. The average saturations of the thirteen companies that do not sell appliances themselves are: Refrigerators 38, ranges 14, water heaters 5, washers 51, ironers 6 and cleaners 63 per cent. And these comparisons will stand some contemplation. It must be remembered, however, that the relationship is for these two groups of companies only. It does not necessarily indicate a general industry-wide condition.

The highest saturations have been achieved, of course, by a combination of light, refrigeration, cooking and water heating, but the degree of a customer's saturation in lighting can hardly be expressed. The extent to which these three appliances have been sold, however, shows some interesting comparisons. Among the companies that merchandise, the highest average annual domestic consumption figure listed in the Eastern section is 816 kw.-hr. It was built up by these saturations: Refrigerators 21, ranges 4 and water heaters 1 per cent. In the Southeast the highest consumption average listed is 1,039 kw.-hr., with saturations as follows: Refrigerators 55, ranges 17 and water heaters 5 per cent. The next is 997 kw.-hr., made up of refrigerators 42, ranges 20 and water heaters 6 per cent saturation. Another in this area, with 899 kw.-hr., has refrigerators 42, ranges 20 and water heaters 11 per cent, and another, with 966 kw.-hr., has saturations of refrigerators 48, ranges 20 and water heaters 6 per cent. The highest average consumption in the Central area has 870 kw.-hr., made up of saturations as follows: Refrigerators 34, ranges 17 and water heaters 9 per cent. The highest average consumption listed in the far West is 1,665 kw.-hr., and this shows these saturations: Refrigerators 30, ranges 25 and water heaters 20 per cent. The next best on the Coast is 1,287, made up of refrigerators 20, ranges 19 and water heaters 13 per cent.

The whole power industry is intent today on growth of load. Growth of domestic load depends on building up the use of light and the major appliances. These have been available to all companies for the same number of years, but there is wide contrast in what has been accomplished. This study of saturations in the different cities gives striking evidence that there is plenty of load still to be built.

Among the non-merchandising companies the highest average annual domestic consumption listed is 1,177 kw.-hr., for a Western power company, and it reports no refrigeration saturation, but lists ranges 31 and water heaters 6 per cent. The next operating in the Central area has a 1,028 kw.-hr. average consumption and saturations of 45, 42 and 11 per cent, while the next, an Eastern company with 973 kw.-hr., reports refrigerators 38, ranges 14 and water heaters 3 per cent saturation.

There seems to be little relation be-

tween the size of the community served by the utility and the degree to which the average annual domestic consumption figures have been built up. The highest consumption average listed is 1,665 kw.-hr. covering 52,862 consumers. The second is 1,287 kw.-hr. and covers 45,649 consumers, the third 1,276 kw.-hr. with 39,682 consumers, the fourth 1,177 kw.-hr. with 32,577 consumers, the fifth 1,046 kw.-hr. with 101,995 consumers and the sixth in size is 1,039 kw.-hr. and covers 131,664 domestic meters. The balance of those above 800 kw.-hr. run all the way from 202,849 to 8,908 consumers on the lines.

The lesson of it all, of course, is the extent of the unsold market waiting almost everywhere. Refrigeration saturations under 30 per cent, range saturations under 10 per cent and water heater saturation anywhere indicate a wide open opportunity for the salesman.

The ironing machine, though proven on the market for a long time and good for 200 kw.-hr. a year, is still listed by most of these utilities at under 5 per cent saturation. And meanwhile, even among these the most active and progressive power companies, we find estimates on clothes washers of 30, 25 and 10 and on vacuum cleaners of 35 and 15, whereas the national saturation is supposed to be 49 on washers and on cleaners 48 per cent.

It is a challenge to every manufacturer and wholesaler, every power company and dealer. For these are not luxuries that follow class fads or season influences. These are labor-saving appliances that do work that must be done daily in every normal home. And if they are marketable to this many customers, then they are salable to many more.

The fact that these accomplished saturations bear so little relation to size of city, rate or the prevailing level of domestic consumption, but makes the argument the stronger. If a high saturation is possible in one community, it is possible in most others, for in each it is a matter of equipping modern families for modern living.

Prevailing Saturations of Major Appliances

Taken from the reports of 90 power companies, of which 77 sell domestic appliances and 13 do no merchandising

Power Companies that Sell Appliances

Company	Total Domestic Consumers Dec. 31, 1935	Av. Annual Domestic Kw.-Hr. Consumption, 1935	% Refrigerators	% Ranges	% Water Heaters	% Clothes Washers	% Ironing Machines	% Vacuum Cleaners
I—NORTHEAST—North of the Ohio River, East of the Mississippi River								
1	771,375	792	40	..	..	50	6	79
3	578,016	617	25	7	1	..	..	..
4	544,553	718	45	4	1	42	3	81
7	319,500	643	..	3	..	..	..	..
10	287,746	788	35	1	..	61	16	63
13	202,489	816	21	4	1	..	..	..
14	201,280	728	42	8	..	51	3	52
17	154,894	751	30	4	..	83	4	..
19	131,099	736	35	6	2	70	10	80
20	128,737	602	25	9	2	..	..	..
21	114,892	478	18	8	1	..	..	..
22	111,210	587	25	1	1	60	1	65
24	86,197	593	40	5	..	80	15	70
25	76,903	633	33	5	..	38	..	56
26	71,472	688	47	3	..	60	10	70
27	65,777	538	49	32	..	..	..	..
28	65,660	563	16	7	2	..	..	..
30	52,005	634	26	10	1	..	..	..
31	48,685	750	26	..	..	40	1	50
32	48,202	531	22	6	..	..	..	..
33	47,945	584	30	3	1	85	5	90
34	41,640	420	24	2	..	..	..	..
35	39,988	567	23	7	..	50	2	17
36	38,615	644	50	9	..	25	5	59
37	36,099	392	25	1	..	..	..	..
39	34,032	645	..	13	..	30	..	68
40	33,351	500	22	11	3	72	3	65
41	30,460	696	37	5	..	55	5	55
42	21,646	573	40	..	..	80	3	75
43	16,850	536	17	7	..	..	..	..
44	12,216	512	14	11	3	60	7	..
II—SOUTHEAST—South of Ohio River, East of Mississippi River								
45	131,664	1,039	55	17	5	25	3	50
47	103,000	901	42	11	4	..	..	..
48	100,533	966	48	20	6	..	..	..
49	79,882	997	42	20	6	..	..	..
50	79,391	899	42	20	11	..	..	..
51	69,000	541	30	6	1	..	..	..
52	68,247	619	36	2	..	60	2	56
54	51,306	599	35	3	..	10	1	38
56	29,006	562	30	8	2	..	..	..
58	26,532	655	33	10	4	..	..	..
59	23,782	735	..	..	9	..	..	..
60	16,482	916	41	14	5	..	..	..
61	14,433	857	39	13	2	..	..	..
III—CENTRAL—West of Mississippi River, East of Rocky Mountains								
62	308,019	685	30	8	2	70	10	70
65	61,551	721	44	1	..	..	..	..
66	58,830	775	46	4	1	..	..	..
67	55,609	685	49	3	..	50	5	80
69	47,078	617	23	4	1	..	..	..
70	41,355	716	37	11	3	21	2	15
71	37,385	582	16	5	4	..	..	..
73	37,145	682	15	12	2	65	12	60
74	32,220	786	37	14	6	..	..	..
75	29,574	364	19	1	..	40	1	60
77	24,200	690	20	18	1	..	..	..
78	22,820	610	32	13	1	..	..	..
80	21,119	571	30	4	..	..	..	..
82	18,885	870	34	17	9	..	..	..
83	16,632	541	27	11	..	..	..	..
84	14,877	487	26	9	1	40	1	35
85	10,541	685	44	5	2	..	..	..
86	8,313	553	33	12	1	..	..	..
87	7,239	530	37	..	..	70	1	75
88	7,037	743	28	16	1	..	..	..
89	6,550	565	26	5	..	63	..	71
90	5,802	600	35	..	..	79	8	60
IV—WESTERN—West of Mississippi River, East of Rocky Mountains								
91	146,522	1,035	16	23	9	..	..	..
92	101,995	1,046	25	21	4	40	4	52
93	100,247	534	29	..	..	55	8	70
94	92,326	790	35	30	2	46	5	48
95	75,351	1,020	51	14	8	70	3	80
96	64,617	645	41	..	..	..	..	..
97	59,592	724	..	20	..	..	..	..
98	52,862	1,665	30	25	20	60	7	75
99	45,649	1,287	20	19	13	60	3	40
100	39,682	1,276	..	46	15	..	..	..
103	20,561	623	20	20	3	..	..	..
Total	9,878,977	*704	*32	*11	*4	*55	*5	*60

Power Companies that Do Not Merchandise

Company	Total Domestic Consumers Dec. 31, 1935	Av. Annual Domestic Kw.-Hr. Consumption, 1935	% Refrigerators	% Ranges	% Water Heaters	% Clothes Washers	% Ironing Machines	% Vacuum Cleaners
3	542,699	761	28	9	4	49	6	65
4	396,157	738	39	7	2	50	5	..
8	94,278	648	40	2	..	70	5	70
9	79,690	611	36	..	..	55	6	60
10	77,681	674	36	..	..	..	10	65
11	73,426	682	32	11	..	..	..	..
12	58,972	973	38	14	3	..	..	..
14	51,661	528	32	1	1	18	1	60
15	50,230	680	39	2	..	..	..	..
16	32,577	1,177	..	31	6	..	..	..
18	17,762	585	34	..	..	65	10	60
19	10,113	769	60	20	10	..	..	..
20	8,908	1,028	45	42	11	..	..	..
Total	2,494,154	*758	*38	*14	*5	*51	*6	*63

*Straight-line average.

Rural Line Economy

Thorough Study of Conductor Properties Affords Basis for Building Good Rural Electrification Lines Cheaply by Using Longest Feasible Spans

Rural electrification is going forward and it must be economically done. If conditions are favorable long spans can save poles. Where not, shorter spans and lower strength conductors with lower cost per unit of conductivity are the answer. The assembled facts and conclusions in this article should encourage more variety of stocked conductors. They cover a wide range of service conditions and should prove immediately helpful to those confronting rural expansion at minimum cost, minimum justifiable energy loss and best chance to increase capacity as the load grows.

By H. E. HOADLEY

Electrical Engineer Empire District Electric Company, Joplin, Mo.

INCREASED span length and reduced number of poles appear to offer the best possibility in keeping rural electric service costs at a minimum. Various wires and cables available afford to varying degrees the properties of high strength and low cost. These properties and the relative costs have been analyzed and the data set up for guidance in planning new construction. For a property which has moderate sleet conditions, roads generally straight and level and tree conditions not severe—all conducive to long span construction—the particular conclusions reached for present price conditions are as follows:

1. Use high-strength cable, size equivalent to No. 5 copper, for overhead ground wires, for sub-transmission conductors and for rural lines.
2. Use No. 8 copperweld steel wire (40 per cent conductivity) on high-line telephones and for side taps on rural lines up to limit of carrying capacity.
3. On rural lines string the conductor for 70 per cent of breaking strength under heavy loading where ice loading is not severe.
4. Use 30-ft. poles on rural lines; Class 6 and spans up to maximum permitted by Safety Code ground-clearance requirements for high-strength cable; Class 7 and spans up to 360 ft. for No. 8 copperweld steel. Guys size $\frac{5}{16}$- and $\frac{1}{4}$-in. Siemens-Martin are suitable for most of the conductors.
5. On sub-transmission lines, where spans are less than, say, 300 ft., where the cable is used for overhead ground wire and the conductors are copper or ACSR having relatively greater sag, the cable should be strung under tension about one-fourth its breaking strength or any value less than this which will give the ground wire materially less sag than the line conductors.
6. The cable should be overpulled when stringing up to at least one-half its breaking strength and left under tension long enough to acquire some permanent set regardless of where it is used.

Six kinds of conductor were studied in the light of current costs and their known properties. Their relative qualitative merits are set up in Table I. A steel conductor will be exposed to rust if the copper or galvanized coating is lost by arcing; the risk is less with copper surface. Ability to stand rough handling when stringing indicates how much care should be used in the process. Relative ruggedness likewise embraces the vibration problem, more acute when tensions are high and spans long. Recent tests indicate that three-strand cables exhibit minimum vibration tendency, with copper giving less difficulty than ACSR. For the latter the armor rods at tie points and long radius bends at dead-ends should be used. Specific absolute values of the fundamental properties of the conductors are given in Table II.

Economic success of a rural line both as regards first cost and subsequent maintenance expense may be marred by improper selection of the conductors and by improper care in stringing them.

If a high-strength, high-cost conductor is bought and full advantage is not taken of its possibilities as to span lengths the line costs too much.

If the spans are made too long and the loaded tensions too high and the poles and guys too light excessive service outage and maintenance will result. When engineering study has been applied to the line design the tendency has usually been to be sure to get it strong enough to withstand the conventional wind and ice loadings. But there are many "haywire" lines which by no means measure up to heavy loading design requirements, but which have served pretty well for years. Simultaneous heavy loading from ice and wind in many places within the N.E.S.C. map heavy-loading districts will not occur during the life of the line, and it may even be

Table I—Comparative Qualitative Properties of Conductors

Material	Cost	Scrap Value	Load-carrying Capacity	Strength	Resistance to Arcing	Ruggedness
Copper	Moderate	High	High	Moderate	Good	Good
ACSR	Moderate	Low	High	Moderate	Poor	Fair
Copperweld-copper	High	Medium	High	High	Good	Good
Calsun bronze-copper	High	Medium	High	High	Good	Good
Copperweld cable	High	Low	Low	High	Fair	Good
Copperweld solid	Low	Low	Low	High	Fair	Good

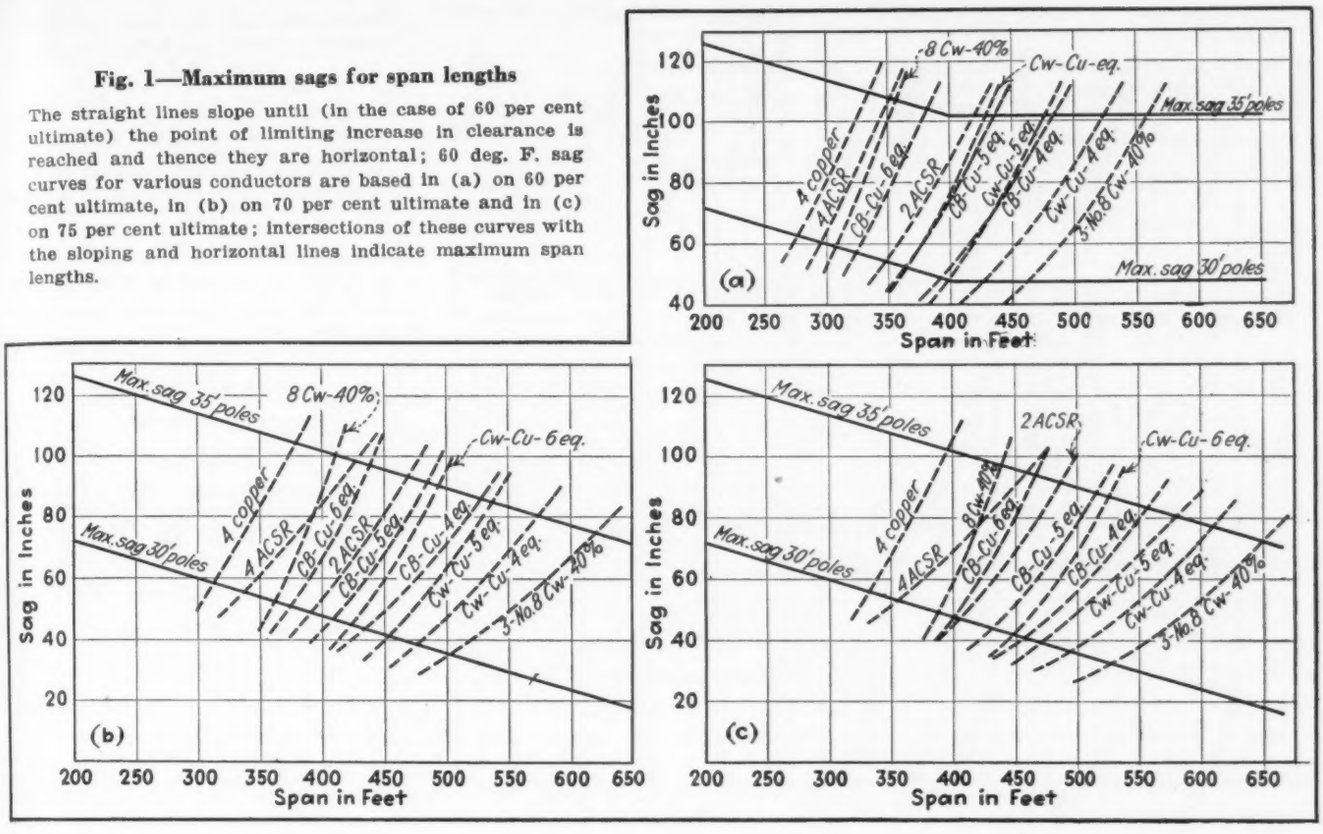


Fig. 1—Maximum sags for span lengths

The straight lines slope until (in the case of 60 per cent ultimate) the point of limiting increase in clearance is reached and thence they are horizontal; 60 deg. F. sag curves for various conductors are based in (a) on 60 per cent ultimate, in (b) on 70 per cent ultimate and in (c) on 75 per cent ultimate; intersections of these curves with the sloping and horizontal lines indicate maximum span lengths.

several years between periods of appreciable ice loading. In these cases it would seem that we can afford to venture a bit for the sake of first cost, provided we stay within the limits set by the Safety Code. Practically, this means providing specified ground clearance at 60 deg. F., but we may string for heavy loaded tension of a high percentage of the conductor's breaking strength, perhaps 70 per cent or more, with suitable material, knowing these values will rarely if ever be realized.

N.E.S.C. Rule 232, Table I, provides for a basis clearance to ground at 60 deg. F. of 18 ft. for lines 750 to 15,000 volts along highways on 150-ft. spans. In heavy-loading districts, with loaded tension 60 per cent or less of the ultimate strength, each 100 ft. added to the span length requires an addition to the ground clearance of 1 ft., with a limiting increase of 2.5 ft. Where the loaded tension exceeds 60 per cent there is no limiting increase and more clearance must be provided for each increment of span length. For crossings over highways, driveways and uneven ground it is suggested that $\frac{1}{2}$-in. ice, 32 deg. F. and no wind be taken. In Fig. 1 are given curves of maximum sag against span length.

It is recommended that wires be supported on wood crossarms in conventional manner. Horizontal spacing should be enough to prevent swinging together, and where there are more than two wires there should be a vertical offset. One method of providing this is shown in Fig. 2. Where the secondary size requirements do not exceed No. 4 copper equivalent a high-strength conductor should be used. The resultant lowered factor of safety on a few poles because of added secondary wires should usually be satisfactory. In cases where exposure to wind is unusually severe it should be possible to provide the necessary increase in strength by placing a storm guy at less cost than adding a pole to each span.

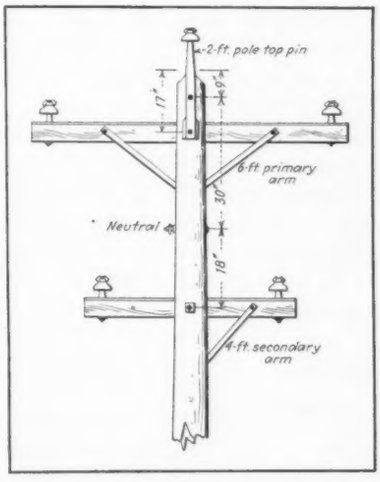


Fig. 2—Pole-top arrangement affords vertical offset with adequate horizontal clearance

As for horizontal separation, the greatest tendency to swing together exists with large-diameter, lightweight conductors strung with large sag. Specifically, it is suggested that for ACSR an 8-ft. primary arm be used and a 5-ft. 7-in. secondary arm with pole bracket for secondary neutral on both 30- and 35-ft. poles. For all other materials a 6-ft. primary with 4-ft. secondary arm and J bracket for secondary neutral on 30-ft. poles is advocated. However, for 35-ft. poles and longer spans the 8-ft. primary arm and 5-ft. 1-in. secondary arm should be used.

Wires should be strung through pulley blocks hung from the crossarms and overpulled, if possible, up to half the breaking strength or a little more, and allowed to remain under tension for at least an hour before slacking off to proper sag and making the dead-end. A dynamometer or calibrated hoist is essential, because proper tension can be read much more accurately than proper sag can be sighted.

Poles and insulators

Insulators should be in keeping with the line voltage and about the same size as would be used in the city.

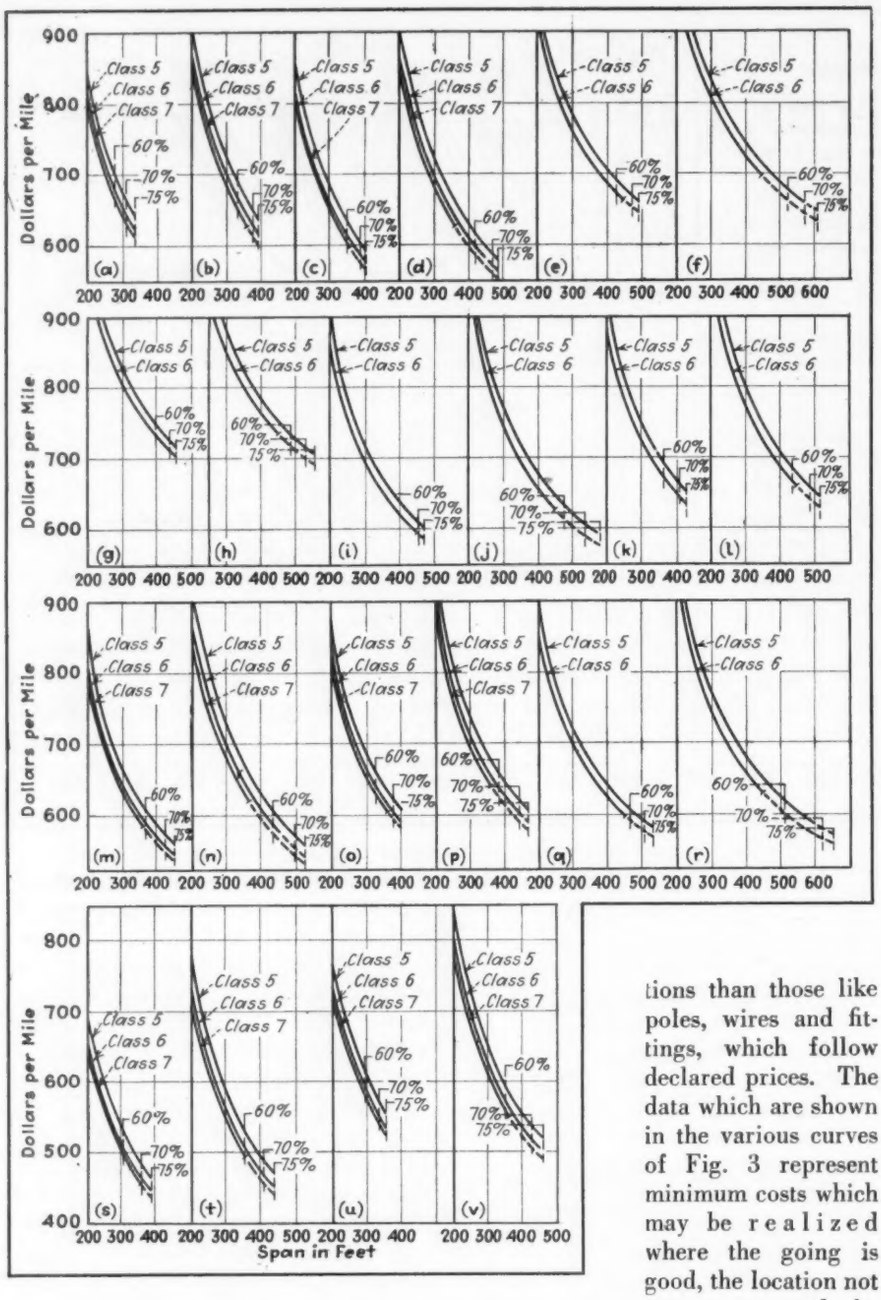


Fig. 3—Cost of rural line as influenced by conductor, pole size and span length

(a) No. 4 copper on 30-ft. poles
(b) No. 4 copper on 35-ft. pole
(c) No. 2 ACSR on 30-ft. poles
(d) No. 2 ACSR on 35-ft. poles
(e) Copperweld-copper (No. 4 eq.) on 30-ft. poles
(f) Copperweld-copper (No. 4 eq.) on 35-ft. poles
(g) Calsun bronze-copper (No. 4 eq.) on 30-ft. poles
(h) Calsun bronze-copper (No. 4 eq.) on 35-ft. poles
(i) Copperweld-copper (No. 5 eq.) on 30-ft. poles
(j) Copperweld-copper (No. 5 eq.) on 35-ft. poles
(k) Calsun bronze-copper (No. 5 eq.) on 30-ft. poles
(l) Calsun bronze-copper (No. 5 eq.) on 35-ft. poles
(m) Copperweld-copper (No. 6 eq.) on 30 ft. poles
(n) Copperweld-copper (No. 6 eq.) on 35-ft. poles
(o) Calsun bronze-copper (No. 6 eq.) on 30-ft. poles
(p) Calsun bronze-copper (No. 6 eq.) on 35-ft. poles
(q) Three No. 8 Copperweld (40%) on 30-ft. poles
(r) Three No. 8 Copperweld (40%) on 35 ft. poles
(s) No. 8 Copperweld (40%) on 30-ft. poles
(t) No. 8 Copperweld (40%) on 35-ft. poles
(u) No. 4 ACSR on 30-ft. poles
(v) No. 4 ACSR on 35-ft. poles

The curves are stopped at span lengths corresponding to maximum permitted by NESC when sagged for 75 per cent ultimate strength of the conductor under heavy loading. Dotted portions indicate that pole factor of safety is less than two for 8-lb. wind on two ½-in. ice-coated wires.

With ACSR it is recommended that armor rods be used at all tie points and a suitable strain clamp used at all dead-ends. For all other conductors the spool-type clevis offers probably the best means of dead-ending up to its voltage limit (about 6.6 kv.), and above this it is recommended that two 6-in. disk strain insulators of the cap-and-pin variety be employed.

Table II shows the theoretical span lengths for various numbers of wires on poles of classes 4 to 7 with initial factors of safety from 1.5 to 3.

Choosing a favorable conductor

Plotting line costs is always open to misinterpretation unless it is adequately emphasized that the figures apply to most favorable other conditions than those like poles, wires and fittings, which follow declared prices. The data which are shown in the various curves of Fig. 3 represent minimum costs which may be realized where the going is good, the location not too remote and the amount of right-of-way clearing not excessive.

The cheapest line results from using No. 8 copperweld on class 7 poles. This combination has the advantage of light wire and light poles, permitting reduction in size of crews. Its load-carrying capacity (135 kw.-miles at 6.6 kv.) is small, only 21 per cent of No. 4 copper; nevertheless, it seems adequate for a 7-mile line with five customers to the mile, each with simultaneous demands of 1 kw. It could well be used for short rural primary lines and for side taps from main lines.

Beyond this application other conductors should be selected to fit as many uses as possible—rural primary, rural secondary and subtransmission (both line conductors and overhead ground wires).

The user should first satisfy himself as to which type of cable best meets general requirements, such as ease of handling, ruggedness, vibration and the like. With these requirements satisfied the choice may well depend on the price situation as it affects total cost, taking into consideration possible span lengths.

Sizes 4, 5 and 6 copper equivalent are most appropriate, and again general suitability will guide the decision for stocking. Size 4 is usually larger than required; in fact, size 6 is often large enough, but consideration should be given to size 5. Taking copperweld-copper as a specific example, line costs for size 5 are 7 per cent ($40 per mile) higher than for size 6, but the conductor strength is 22 per cent more and the load-carrying capacity 35 per cent more. As secondary, No. 6 would make a one-span extension for a range load and No. 5 two spans. As ground wire No. 5 has about the strength of No. 2 copper and should suffice for all situations. For subtransmission conductors, when sagged for 60 per cent ultimate under

heavy loading, No. 6 with normal sag of 10 ft. would stand a 450-ft. span with about 260 lb. tension, while No. 5 for the same span has a normal sag of only 7 ft. with tension of nearly 500 lb., both factors reducing the tendency to swing or whip together. For these reasons size 5 seems definitely indicated as compared with size 6.

Choice between 30- and 35-ft. poles for rural lines should be governed by the following considerations:

Line cost per mile.
Conductor tension and ratio of sag to vertical separation, primary to secondary.
Midspan ground clearance under ice load.
Take-off height for services crossing a highway.
Ability to withstand wind pressure.

Again taking No. 5 equivalent copperweld-copper cable as an illustration, the adoption of stringing to 70 per cent of ultimate will allow spans on 30-ft. poles up to 450 ft. and on 35-ft. poles up to 530 ft. on the basis of N.E.S.C. ground clearances. The curves show the line cost per mile for these span lengths to be substantially the same for both lengths of pole, but since it is harder to realize the higher average values of span length the consideration on a cost basis should be slightly favorable to the 30-ft. pole.

Sag and tension curves for No. 5 equivalent copperweld-copper cable show that for 35-ft. poles and 530-ft. spans the normal or 60 deg. F. tension is 660 lb. and sag 81 in. The ratio of sag to vertical separation (primary to secondary) is 1.69. For 30-ft. poles and 450-ft. spans normal tension is 920 lb. and sag 41 in.; ratio of sag to primary-secondary separation is 0.85. This ratio is believed low enough to insure against danger of wires swinging together or jumping together under configuration of Fig. 2. It is not low enough in the case of 35-ft. poles, and that indicates the choice of 30-ft. poles and 450-ft. spans.

Midspan ground clearance at 60 deg. F. is about 22 ft. for 35-ft. poles and about 21 ft. for 30-ft. For ½-in. ice the figure is about 15½ ft. for both pole sizes. The secondary is 4 ft. lower, but except for crossing, driveways or overbuilt trees that 11½-ft. clearance should be satisfactory for traffic likely to exist when such loading holds. For service take-offs it is nearly always necessary to set another pole for road clearance even if the take-off pole is 35 ft.

For equal span lengths and a given class of pole one length theoretically is as strong as another against wind pressure, but it is obvious that the longer poles are more likely to lean over in soft ground—a 35-ft. pole has only 7 per cent more area at the ground line to withstand 18 per cent more pressure, due to the longer lever arm, as compared with a 30-ft. pole. If class 6 poles are used for rural lines the factor of safety for heavy loading for two primary wires on 450-ft. spans is 2; if a third primary wire is added later, the factor of safety drops to 1.33. Storm guys can be used if this is insufficient. If, however, 35-ft. poles are used with 530-ft. spans to bring the cost of the line down to a 30-ft. pole basis, the pole factor of safety is only 1.7 initially. Adding a third wire would bring it down to 1.13, which is probably a bit too low and would at least mean more storm guys.

Table II—Specific Properties of Various Rural Line Conductors

Load-carrying capacity is in kilowatt-miles at 4-ft. spacing, 0.9 power factor, single phase, 6,600 volts, 60 cycles and 5 per cent regulation. The figure is doubled for three phase. A large modulus (steel) means small increase in sag with increased loading as compared with a low one. The final column indicates cost per mile of two-wire primary with greatest span lengths permitted by ground clearances of National Elec. Safety Code.

Material	Load-Carrying Capacity	Strength	Weight Lb. per Mile	Melting Point Deg. F.	Modulus of Elasticity	Line Cost per Mile
Copper, 4 solid	635	1,970	667	1,981	16,000,000	665*†
ACSR, size 2	635	2,660	486	1,218à2,500	11,000,000	585
ACSR, size 4	430	1,665	306	1,218à2,500	11,000,000	550
Copperweld-copper, No. 4 equiv.	635	3,930	850	1,981à2,500	17,000,000	650
Copperweld-copper, No. 5 equiv.	580	3,190	675	1,981à2,500	17,000,000	595
Copperweld-copper, No. 6 equiv.	430	2,580	533	1,981à2,500	17,000,000	555
Calsun-bronze-copper, No. 4 equiv.	635	3,475	927	1,981	14,000,000	710
Calsun-bronze-copper, No. 5 equiv.	580	2,780	735	1,981	14,000,000	695
Calsun-bronze-copper, No. 6 equiv.	430	2,220	582	1,981	14,000,000	605
Copperweld, 3 No. 8—40% cond.	375	4,210	729	2,500	23,000,000	575
Copperweld, 1 No. 8—40% cond.	135	1,650	240	2,500	24,000,000	455*

*30-ft. Class 7 poles, all others 30-ft. class 6. †Span lengths based on stringing for 60 per cent ultimate strength made heavy loading, 70 per cent for all other conductors.

Floods Help Fill Norris Dam Pool

Photo by Charles Phelps Cushing

While the gates at T.V.A.'s big Norris Dam have been closed only a short time, the lake is seen to be half full. Recent rains and flood waters were in no small part responsible

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Schooling From High Water

WHAT precautions can be taken at reasonable cost to minimize flood damages to electrical equipment and service in exposed locations? Full protection is generally too expensive in the face of overflows breaking half-century records. Steam plants must have access to enormous amounts of circulating water and cannot be located on hills even at the suggestion of optimistic laymen. Hydro stations must work in valleys and motors cannot be installed with reference to civil engineering bench marks. Coal fields may be diked at river levels for a fair measure of protection, but these also are subject to hazards which cannot be insured 100 per cent even by the ablest of plant designers.

Much can be done, however, to safeguard plant from preventable failures due to what might be called minor hazards. In the recent floods these proved capable of causing endless trouble. As the waters rose resourceful operators saved a good deal of equipment by moving it to higher station levels. Motors were detached from oil and circulating pumps and carried beyond flood reach by plant elevator equipment. Control batteries were disconnected from the switchboard and sometimes moved upstairs. Station service transformers were hung from traveling cranes, furnishing energy from interconnections for lighting and small power throughout the emergency.

These expedients point the way toward permanent relocation of a good deal of vital equipment, both in established plants and in future designs. Storage batteries have been improved greatly in recent years and are now being admitted to the polite society of upstairs apparatus. Greater care to avoid leaving openings in walls and duct ends to furnish channels for torrents of flood water will pay real dividends. Motor-generator sets need not be exiled to flood levels. In brief, a realignment of apparatus has become timely.

Interconnections proved their value as never before. High mounting of transformers and oil circuit breakers in outdoor substations enabled service to be more swiftly restored, but in some cases the flooding of low-mounted solenoids, trip coils and other auxiliaries proved a handicap. Designers of such equipment are now considering the wisdom of rearrangement even at the sacrifice of instant inaccessibility from the ground level, at least for substations which cannot be located on higher ground than allied generating plants. Generating units and other heavy apparatus provided with vacuum-filled windings came through remarkably well, and even where completely submerged were rapidly restored to operating condition by washing out, cleaning, artificial drying and progressive testing. Thousands of alternating-current motors renewed their reputation for ruggedness, many operating for hours under water. The percentage restored to duty is still unknown, but must be very high.

Incandescent lamp stocks in representative cases were salvaged to the tune of 99 per cent after one or two days of complete submergence, and even here the damage was chiefly due to mechanical injury when tens of thousands of such bulbs were literally shoveled along the floor against the wall prior to reclaiming. Small meters were replaced in great number by factory shipments as the quickest and cheapest solution. Salvage methods of proved value made good again. It should be borne in mind, nevertheless, that all electrical equipment, including cable, subjected to flooding deserves close watching, and that weak spots may develop in the coming months which will add valuable lessons to those imparted in the early days of the harsh school set up by Old Man River in his recent truancy from the narrow path of normal flowage.

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Deferred Inspection Is Costly

THE one-time practice of periodically checking transformer oil in the field and filtering if necessary has apparently gone into the discard on some properties during the past few years of forced reduction in expenses. Many transformers brought into utility repair shops show greatly depreciated oil strength, excessive sludge and the concomitant blocking of ventilating ducts.

How can transformers or any other apparatus dependent on oil for dielectric strength and cooling be expected to stand up under such conditions?

It seems like a "penny-wise pound-foolish" practice to eliminate or excessively separate such periodic field tests. Consider the amount of field and shop labor that is necessary to remove the transformer from service, substitute another, transport the faulty one to the repair shop, test, drain, untank core, remove coils and possibly all laminations, clean, repair, dry, bake, retest and prepare for transportation to point of reinstallation. To this labor must be added the expense

of materials, for repair and replacements, and the loss due to junking removed material—no small item.

True economy must consider the combined cost of inspection and maintenance and hold it at a minimum. Many times, money spent on inspection will save considerably more money on maintenance.

The folly of delayed maintenance is beginning to show up in a deluge of costly repair work, which requires removing equipment from service when the load is increasing rapidly.

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Economic Use of Gaps

A DECREASE in trip-outs and line damages results from the use of expulsion gaps and Deïon tubes on transmission lines to protect against lightning. Field experience gives evidence of improved performance, especially if the gaps are co-ordinated with other protective features. It is still an economic and technical question as to how many gaps and what rating of gap to use on each line. On high-voltage lines gaps are placed on each structure, but on lower voltage lines cost elements favor their use on alternate or even on very fourth structure. Also, since lightning current and flashover current magnitudes vary over a wide range, it is difficult to decide the size of protector tube to use—again, a cost question. A still further unknown is the effect of weathering and aging on gap performance.

Field operating data should be kept so that the answer to these problems may be found as quickly as possible.

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Low Saturations— Symptoms of Neglect

THERE is a sermon for executives of power companies in some of the appliance saturation figures presented in this issue. To find them, it is only necessary to sit down in a comfortable corner and compare the load conditions they reflect with your own company's accomplishment. But some of the conclusions that will automatically be drawn may not be comfortable.

The important point, however, would seem to be not that this utility has built a high electric range use or that company has been particularly successful in developing water-heater load. The surprising thing is that, so far, so many have made no progress in selling this or that appliance, for which other companies have developed an extensive market. For after all, these things are of universal value, since all homes in every city must protect food from decay, must cook, heat water, launder clothes and clean floors.

It is interesting also to weigh the average domestic consumption in different cities against these saturations. It shows how many ways there are to increase revenue. For example, one large city with an average consumption of 792 kw.-hr. has sold practically no ranges or water heaters, but by continuous aggressive merchandising of small domestic appliances, for years, it stands today well above the industry average. And in a great metropolis this is hard to do.

Just so, some cities have secured a very respectable return per customer by the persistent and intelligent selling of larger lamp sizes. Here lighting load has been the leader and few major appliances have been put on the lines. And some companies have done as well up to now, by promoting sales through dealers, as those which have been actively merchandising.

In other words, load can be built in many ways. But why do few companies seem to be aware that they can actively promote many, if not all, types of load at the same time? In most cities they specialize on one or two appliances and neglect the rest. Yet all are salable.

The most impressive feature of this array of saturation figures, therefore, is these weak spots, these scattered symptoms of neglect. Every company would do well to check its record from this point of view.

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How Not to Fix Rates

THREE years ago the city of Miami ordered Florida Power & Light Company to reduce its electric rates by approximately 25 to 33 per cent. The power company's management appealed to the federal courts for protection against confiscation of the property owned by some thousands of Florida citizens. The court appointed a special master to hear the testimony.

A primary issue was a determination of what property was used and useful in serving Miami. Should the rate base include that portion of a state-wide interconnected system used day in and day out to supply Miami, or should the rate base consist only of property inside the city limits possessed of insufficient firm capacity to serve Miami, assisted over seasonal peaks second to none in the United States by the interconnected system? A fact up against a theory.

Miamians turned meanwhile to their sail fishing, bathing beaches and real estate boom. But at last the mills of the gods have ground out the answer: It is, in effect, "Yes and No." The long opinion of the master left the case "wide open" for final adjudication by a trial court.

To date, the case has cost at least a half million dollars, and the result is three years of nothing for ratepayers and taxpayers. The ratepayer loses the benefits of reduced rates now enjoyed by his neighbors across the city line. The taxpayer puts up the money for the imported experts. The utility company loses working capital ordered impounded against a possible adverse decision, and does it to the tune of $50,000 per month. Who loses and who gains by this kind of procedure?

Heaven Spare the Gullible

CAN this country continue to prosper without "sucker money"? Sounds silly, but this question is far from humorous. It is as serious as the tax bill, and quite possibly more important! The tax bill can be changed next year. In fact, it will be. Probably more of the same, assuming a continuance of present governmental policies.

But the very tax policy itself is part of the importance of this problem involved in "sucker money." So is the securities act and any modifications which may be made to it later. So is almost everything the government is doing in its striving for the Roosevelt dream of a more abundant life.

For this country has grown great, among other things, because of the amazing opportunities afforded by "sucker money." Opportunities to develop new things, to improve existing methods and conditions, to replace squalor with comfort, to shorten hours of labor without penalizing the laborers, to travel quickly and with comfort instead of slowly, with discomfort.

An astonishing percentage of all the improvements in living conditions since the Civil War, to take a span of time which many living persons can remember, has been accelerated, if indeed not made possible, by "sucker money."

THE vitally important point at the moment is that President Roosevelt is enthusiastically committed to the total elimination of "sucker money"—that he has already moved a considerable distance on the road to this objective—and that he hopes to reach the goal before 1940.

It is just possible, of course, that Roosevelt may be right. It is conceivable that this country can continue to prosper, to go forward, without "sucker money." One can imagine that, with a bit of difficulty. But human nature being what it is, and with the old adage in mind that one can only judge the future by the past, it takes some straining!

Let's take a look at the old system and contrast it with what the New Deal would substitute.

By "sucker money," of course, no reference is intended to such "deals" as the payment of $10,000 to a confidence man for a half interest in the Empire State Building, or the purchase of a gold brick. There are and always have been plenty of laws to take care of that type of fraud.

"Sucker money" is money invested in some new enterprise, frequently without the slightest employment of intelligent judgment on the part of the investor, in the hope that a small investment will make the "sucker" rich. Sometimes the investor knows he is playing a long shot—that the chances of his ever seeing a penny of his money again are a hundred to one, sometimes a thousand to one, against him. Sometimes he is carried away by his own enthusiasm for the idea involved in the new project—does not think he is gambling at all. Sometimes he errs grievously as to the barriers and ditches which bar his path to riches.

Generally he loses. But once in a while he wins!

Now, from a moral standpoint, of course, all this is deplorable. It is sheer gambling, for the most part, and there is a widespread tradition that gambling is wicked. There is an even more widely accepted judgment that it is foolish.

But how we do love it! Even when we know the cards are stacked against us. Even when we know the horses sometimes are doped, infrequently are pulled, occasionally are temperamental, and always lose money for us in the long run. Even when we know that brokers' fees and interest, bad tips and belated inside information, plus the human desire to pyramid, generally spell destruction in the stock market.

IT'S THE same way all through human life, whether we consider a slot machine or bet on rain and against drought on a crop of wheat. The only difference is that in virtually all forms of productive enterprise, and many that are not productive, we *have* to gamble. There is no way of avoiding it.

Let's take a look at things which Mr. Roosevelt can see in half an hour's drive around Washington. Just up Connecticut Avenue from the White House is a fine, fairly new hotel. It was conceived because Washington, right after the war period, needed hotels terribly. Rooms were always at a premium. It looked like a splendid business venture. The promoter and builder was a man with an enviable record for sound judgment, prudent investment and able building. To this day no one has ever said there was no need for this new hotel. Few have ever criticized its location, or plans, or the execution of those plans. As a matter of fact, the hotel has been popular and well patronized since the day it opened.

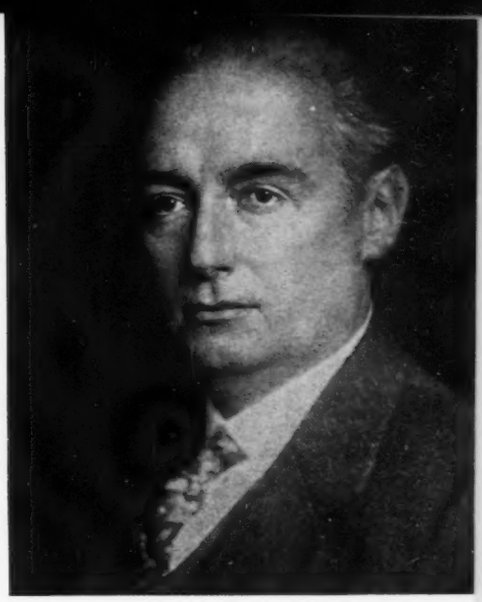
But—every dollar of the original investment was lost! The up-to-then-successful man who conceived the idea and built the hotel died from a broken heart. Everybody who tried to help him lost his money. Not only that, but the second group who put up money and took the hotel over also lost their shirts!

Washington, and Washington's visitors, benefited. There was the hotel to serve them, a hotel vitally needed. It is there today, with not a room to be had for love or money on the day this article is written. And it was built with "sucker money."

Overlooking Rock Creek Park, near the end of the famous Connecticut Avenue bridge, is another big hotel, built years later. It has enjoyed an enviable patronage since the day it was opened. But it was in the hands of receivers before it was completed. So the "sucker money" which provided this very much-needed addition to Washington's facilities was lost here also.

The same is true of another very fine, though smaller, hotel, a few blocks directly North of the White House. Here again the promoter and builder had a long line of successful operations with which to point with pride as he coaxed investors to join him in his new enterprise. He went broke, but the hotel is a success. Again "sucker money" provided something that was very much needed.

—By CARTER FIELD



This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

If the President would glance at the new office buildings as he makes this drive and would inquire as to their stories he would find them almost invariably the same. Nor would the tales vary with regard to the new apartment houses he would see. Yet the pressure for office space in Washington is such that the government is an active bidder to rent not only offices but apartments and private homes all over town! So that in many of these instances "sucker money" is actually serving the New Deal most capably! Though perhaps with a bit of a bad taste in the mouths of the suckers!

These cases are cited because it would seem that building a new hotel, or office building in a community where these were obviously needed has less of a gambling element than almost any new venture. It would not compare in risk, one would think, with a new mining development, or putting money into a company which hoped to find oil, or financing the exploitation of a new invention.

It is really the last where "sucker money" has played its most important part. Suppose the now very conservative Senator Couzens had not put up some "sucker money" and taken a chance with Henry Ford. Suppose the Dodges had been equally cold and "sensible." It is simple to say that Couzens would not be the owner of millions of government bonds, and would not be a Senator at all. Or to say that the heirs of the Dodges would not be rich. But suppose *nobody* had taken a chance with Ford! Or with any of the motor pioneers!

CAST your memory back to the names of automobiles which were popular in the early days of the industry. Or much later for that matter. A New Dealer would weep bitter tears over the hard-earned savings which were lost in these enterprises. But he deplores almost equally that the beneficent government of those days did not take more of the profits of the winners!

Now why does the sucker insist on risking his money against such terrific odds? Obviously because he hopes to make a killing. He has heard about some one else who did. In fact, the promoter has quite a few appealing stories of such episodes. It isn't necessary to paint the lily. So he leaps in, risks his savings, and, very seldom unfortunately, contributes to something which by its success helps everything and everybody, makes life more worth living not only for his own family, but for the world.

When his money is lost, incidentally, which of course is most of the time, where does it go? Again eliminating clear cases of fraud, for which there is adequate law. Why, it normally goes into wages and materials, which are wages. True, the labor in these unsuccessful enterprises is wasted, in some cases. Though this is not always true. As in the cases cited of Washington's hotels and office buildings. But even where the enterprise is a total flop it did provide employment. And perhaps not more deplorable than the waste of labor on the Florida Ship Canal, or Quoddy, or the boondoggling relief projects, at that!

But why, one may ask, is this important now. Won't "sucker money" keep right on aiding the development and improvement of our country?

Maybe. On the theory of the gambler who knew the game he was playing in was crooked, but retorted that it was "the only game in town."

BUT the New Deal is hitting at this flow of "sucker money" from every angle. The average sucker likes to be told if he buys stock in this new enterprise he is just bound to get rich. It's surefire. Under the securities act the promoters cannot tell them that any more. Certainly not in print.

But how about the prizes? How about the big killing when the sucker does pick a winner?

That's where the real rub comes in. The sucker doesn't want a safe 5 or 6 per cent. He wants a bonanza. And under the new tax plans there just aren't going to be any bonanzas—that is, not for the suckers. They will be bonanzas for the Internal Revenue Bureau of the U. S. Treasury.

Let's look at the Ford case again. Suppose the government had taken 15 per cent of all net earnings of that little company when it first started, and then on top of that taken around 40 per cent of all earnings plowed back into the property. Would the original investors have made the killing that they did? Or wouldn't the first hard sledding have thrown control of the then little company into the banks? Which, as a matter of common knowledge, *almost* happened anyhow!

And suppose a Labor Relations Board was camping all the while on Mr. Ford's neck during those early days. And a Social Security Board cutting into scanty wages he was able to pay. And the Internal Revenue boys telling him he did not keep his books right. And a New Deal type Federal Trade Commission telling him his methods of competition were unfair. And some other federal agency telling him he could not make his agents contract to sell so many cars, or so many parts, or pay for them in advance, or what have you!

But in those days the sucker did win, at least once in a while.

NEWS OF THE WEEK

Virginia and R.E.A. start "second battle of Chancellorsville" in dispute over farm line extensions . . . Duke Power appeals Buzzard Roost case . . . F.P.C.'s Rate Series No. 6 lists state commissions' powers . . . U. S. Chamber would ban federal power projects

Business Men Rap U. S. "Yardsticks"

Committee of U. S. Commerce Chamber lists flood recommendations, asserts government has no social or economic right to produce power

"The entrance of the federal government into the business of generating and distributing electric energy has neither social nor economic justification." The Chamber of Commerce of the United States will have before it this flat statement of its committee on water resource policies at its forthcoming meeting in Washington.

Flood control is the main topic of the report, which urges that the program be carefully weighed by both federal and local authorities. The division of costs receives particular attention. Says the committee, in its summary of recommendations:

"Only when flood control projects are on major streams and affect a large number of states and are of unquestioned concern to the country as a whole should primary responsibility rest with the federal government."

Development of water power by public bodies in the name of protecting water resources comes in for detailed discussion and, as its reasons against the federal government getting mixed up in it, the committee lists:

"(a) The light and power business is essentially intrastate in character and responsive to local need and market demand, and subject to state regulation and control.

"(b) Either to destroy existing capital locally invested or to render a local utility service by any other than the least expensive means consistent with adequate and dependable service, solely for the purpose of utilizing a constantly available resource, has neither social nor economic warrant.

"(c) The generation and distribution of electric energy produced from water power as a by-product of some federal enterprise should be undertaken by local agencies in response to local demand."

The report points out that generation of "incidental" power by means of flood-control dams is fallacious, declaring that these dams' pools must be empty at times when floods are anticipated and that they must be drained in preparation for the next flood. Their utility for flood control is minimized if they are constantly partly full so as to produce power at all times.

"It is the emergency legislation following the depression that has enabled the federal government to engage extensively in the building of dams," the report declares, "and although they are allegedly justified on an economic basis of water power, flood control and navigation, the emphasis has been on social value. In normal times the wisdom of such undertakings would be carefully measured in economic terms."

Virginia and R.E.A. Re-enact Battle of Chancellorsville

State corporation commission overrides federal agency, orders private company to run line to Chancellor, although Washington says it cuts in on territory of rural co-operative.

A skirmish that may develop into a new "battle of Chancellorsville" has opened with the Virginia Corporation Commission taking direct issue with the federal Rural Electrification Administration in allowing the Virginia Electric & Power Company to extend a line from Fredericksburg to the settlement of Chancellor. The power company previously had been told by R.E.A. not to build this extension, the government agency contending that it infringed on the territory of the state's first rural co-operative organization, the Farmers' Rural Utilities, Inc., which has been granted a $366,000 federal loan.

The tangle is a real one. The "co-op" already has received bids on 64 miles of lines and plans to construct about 400 altogether. Shortly the commission is to hold hearings and pass on the proposed lines. Meanwhile, however, the regulatory body has heard evidence from 30 farmers, most of them dairymen, on the Fredericksburg-Chancellor line. These farmers all declared that they wanted private service rather than, as they expressed it, lines built by Washington subsidy. Wherefore the commission decided that:

1. R.E.A. has no legal authority to check the rural electrification program of a private power company, even in an effort to advance the R.E.A.

2. The state has exclusive jurisdiction in this matter.

3. The private company can give the farmers on this particular line quicker and better service because its construction facilities are better and the line will be shorter.

The order grew out of an open conference rather than a formal hearing. Nevertheless, the commission gave warning that if anybody wants to start a battle over the ruling, the body will institute formal proceedings and fight it through. This attitude was based on the farmers' contention that Virginia Electric & Power will give them service in 60 days, but they don't believe they will get electricity from the "co-op" in much less than 60 years. The witnesses asserted it would be entirely uneconomical to run a line 40 miles from the "co-op's" headquarters in Bowling Green, much of the distance being through unproductive territory.

R.E.A. officials in Washington have declined to make any comment on the Virginia commission's "informal" action.

Other rural electrification news items include the following:

ARKANSAS—Harvey C. Couch, president, announces two new rural lines for Arkansas Power & Light, costing $14,000, to provide service to 98 customers in Philips and St. Francis counties.

GEORGIA—Plans are being make for a

rural electrification project in Lamar County, Ga., comprising about 60 miles of lines to be linked with "co-ops" in neighboring counties. The directors are working with County Agent J. S. Harden.

IDAHO—Preliminary meetings are being held looking to formation of a rural electrification co-operative in Benewah County.

MISSOURI—Some 500 residents in eastern Jackson County are reported to have signed petitions for electric service and steps are being taken to gain R.E.A. assistance.

MARYLAND—Attorney-General Herbert R. O'Conor has ruled that an agricultural co-operative, formed as a buying agent for a group of farmers, has the right to extend its activities to include purchase and distribution of electric energy. The number of electrified farms in Maryland has increased from 1,000 to 7,000 in the last fifteen years, according to A. V. Krewatch of the state extension service.

MISSISSIPPI—A bill is pending in the state Legislature, with the unofficial blessing of T.V.A., R.E.A. and P.W.A., to set up the Mississippi Rural Electrification Authority. If created, the authority will be authorized to sponsor extension of cheap power to all sections of the state, using federal loans and connecting with government lines such as those of the T.V.A. The move also is sponsored inferentially by the statehouse, Gov. Hugh White having been elected on a platform of cheap power extension. An amendment, however, has been inserted to make the public projects pay the same taxes as private utilities.

WASHINGTON—Private utilities in the state have agreed to construct lines wherever the prospective annual return equals 25 per cent of the cost of extensions, service to be provided at standard rates. Where the return is smaller, customers will foot part of the construction bill. The state expects 1936 extensions under the plan to total $250,000 to serve 5,000 farms.

WISCONSIN — A farmers' co-operative headed by John Crombie, Columbus, is planning a 224-mile line in Dodge, Dane and Columbus counties to serve 800 customers. An R.E.A. loan is sought and energy would be bought from the Columbus municipal plant.

Duke Appeal Filed with High Court

Southern Utilities Company joins in appeal for ban on Buzzard Roost plant — Petition charges invasion of states' rights — No decision likely until fall

Appeal from the lower court decision in the famous Buzzard Roost case was filed last week with the U. S. Supreme Court by the Duke Power Company and the Southern Public Utilities Company. Only a few weeks remain before the Supreme Court's summer recess, and while there is a possibility that the case may be heard before the vacation, most observers believe it will be difficult for the arguments to be heard until the fall.

The Buzzard Roost case originated when Greenwood County, S. C., sought a P.W.A. loan and grant for the hydro-electric development. Immediate opposition arose from the power companies which had been serving Greenwood and adjoining county consumers for many years and they sought and obtained an injunction restraining P.W.A. in the federal court for the western South Carolina district, but Administrator Ickes appealed and the Fourth Circuit Court reversed the lower court finding.

Lawyers, headed by Newton D. Baker, who filed the Duke petition with the Supreme Court last week, attacked the P.W.A. loan-and-grant program. They asserted that the Circuit Court erred in holding that, under the general welfare clause of the Constitution, Congress has power to authorize loans and gifts of federal funds for construction of a power plant for manufacture and local intra state distribution of electricity. The lawyers maintained that the rights of the states were invaded, that the power companies would be deprived of their property without due process of law and that the Buzzard Roost plant was to be built as a "yardstick in order that the federal government might, through such use of its revenues, control intrastate rates on the sale of electric power and energy."

Reviewing the opinion written by Senior Judge John J. Parker of the Circuit Court, the petition alleged that the Circuit Court conceded that "under ordinary circumstances the power would not exist to raise and expend" federal funds for such a project.

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P.W.A. City Loan Test Suit Starts

Hearings in six utility suits to test P.W.A. grants to cities for municipal power systems (the suits have been consolidated for convenience and to provide a broad test) opened before the District of Columbia Supreme Court this week. Advance indications are that the utilities will try particularly to prove that P.W.A. has a "power policy," despite public denials.

The plaintiffs are Alabama Power (two suits), Texas Utilities (two suits), Iowa City Power & Light and Oklahoma Utilities. The Oklahoma, Alabama and Texas companies have been taking depositions all over the country, the purpose being to show that P.W.A. representatives have been actively encouraging municipalities to build plants or distribution systems which would oust the private power companies. In Missouri their lawyers heard charges that Col. Hugh Miller, P.W.A. representative, openly campaigned for a bill, defeated in the Legislature, which would have facilitated municipal ownership. The contention was that he acted in his official capacity; government lawyers sought to prove that he acted as an individual.

Alabama Power, as the case opened, succeeded in introducing evidence that it offered to sell its facilities to several cities before they were offered P.W.A. money to build competing systems. This testimony was received over vigorous protest by government counsel. James M. Barry, vice-president and general manager of the Alabama company, was the witness.

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New Facilities Rushed

With the foundation completed, workers are now putting steel girders in place on the $2,000,000 addition to Virginia Electric & Power's Twelfth Street station in Richmond.

WORKING DAY AND NIGHT AT PICKWICK

General Electric

T.V.A. officials figure that all their plans are legal since the Wilson Dam decision in the Supreme Court and are pushing ahead with night shifts at the Pickwick Landing project. The night hours are turned into day with 234 General Electric floodlights; more may be added.

State Commissions' Authority Listed

Federal Power Commission issues "Rate Series No. 6," dealing with powers vested in the various regulatory bodies — Delaware alone has no control

Jumping reports No. 4 and No. 5, which are not quite ready for the printer, the Federal Power Commission has made public Rate Series No. 6, which deals with the delegated powers and derivative policies of the state public service commissions. The report is purely factual; it makes no effort to draw conclusions, analyze reasons or appraise results. It starts off with a tabular presentation of "yes" and "no" answers on 22 questions submitted to the state commissions and revised to be complete as of October, 1935. It provides a variety of data. The following quotations are typical:

"Forty-seven states and the District of Columbia now have regulatory bodies with jurisdiction over some class of utilities. Five of these states . . . have no jurisdiction over electric utilities. . . . Delaware is the only state without any regulatory body for public utilities. . . .

"Thirty-eight of the forty-one state regulatory bodies having jurisdiction over electric utilities report that they have the authority to regulate rates charged by all privately owned utilities. . . . Twelve states reported that they have jurisdiction over rates charged by municipally owned electric utilities both within and without the corporate limits of the municipality and nine states advised that they have such jurisdiction only outside of the city limits. . . .

"Seventeen commissions indicated that contracts between operating utilities and management companies, legal firms and other organizations rendering service to them require commission approval. . . .

"Municipal utilities have no legal right to serve customers outside the corporate limits of the municipality in four states. . . . In eleven states they have an unconditional right to serve outside the city limits. . . .

"Thirteen commissions reported that they have formulated state-wide rules governing the service conditions in rural territory. . . . Thirty-five states replied that the amounts of deposits are regulated by the commissions. . . . Submetering is either prohibited or discouraged in the majority of the states. . . ."

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Schenectady Meeting Pays Tribute to Steinmetz

The example of Charles Proteus Steinmetz—a man of broad human understanding, on the one hand, and a scientist of the rarest brilliance on the other—was given to young engineers by Gerard Swope, General Electric president, in the tenth annual Steinmetz memorial lecture before the Steinmetz Memorial Foundation in Schenectady, N. Y., last Monday evening.

Mr. Swope pointed out that Steinmetz had a splendid education along broad theoretical lines and questioned if American engineers are not too early limited to a technical field.

New Tax Bill Hits Holding Companies

Official Washington again has launched an effort to tax intermediate holding companies out of existence, this time by means of the new tax bill. Originally this bill was supposed to exempt corporation income passed on as dividends. Now, however, it contains a joker—if company A derives 80 per cent or more of its income from dividends it will receive no exemption for dividends it in turn pays to company B, which owns over 50 per cent of A's stock.

The tax on an intermediate holding company's dividends may run as high as 42½ per cent; if there are several such companies below the parent company, income will be decimated before it reaches the top.

New Deal Blamed for Unemployment

Politicians have sought to put the entire blame for the depression on business, but if Washington will undertake to remove the restrictions it has imposed upon industry the utilities alone will reemploy "tens of thousands of people," according to Wendell L. Willkie, Commonwealth & Southern Corporation chief executive.

Speaking over a nation-wide radio hook-up, Mr. Willkie declared that if the Administration had been satisfied with sane regulation the country now would have hurdled most of its economic barriers. The death sentence legislation alone, he added, blocked an estimated $3,500,000,000 of public utility expansion expenditures.

"The price which the American public has paid in order that the politicians could enjoy and exercise their hatreds has been incalculable," he added.

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Duke Gets New Customers

Duke Power Company reports that 25 new textile plants were established in the South last year and that 74 expanded existing facilities. Eight of the new plants were hosiery mills, all in Duke's territory.

The Current Drift

Fate of M.V.A. in Doubt

If there is any such thing as a "yardstick" for rates, then it would appear that the broader the territory it covered the better. Therefore it is somewhat difficult to see how Senator George W. Norris' Mississippi Valley Authority plan is taking a back seat in Washington—the same Washington which is still enthusiastic about T.V.A. (After all, M.V.A. is T.V.A all over again, only much bigger.) Is it the election year (when taking sides on controversial issues is bad taste for those seeking reelection) or is it the fact that more and more people are coming to realize the truth about "yardsticks"? Anyhow, the boys are losing interest.

F.P.C. and the State Commissions

Elsewhere on this page is published a news story on the Federal Power Commission's "Rate Series No. 6." It constitutes, by implication, another effort to prove that the F.P.C. is necessary to implement the powers of state regulatory bodies which, for one reason or another, find their wings clipped.

It is necessary only to cite the F.P.C.'s recent attitude toward the New York state commission (ELECTRICAL WORLD, April 18, page 7). This column does not undertake to assert that either the F.P.C. or the state commission was right in the instance mentioned, but rather that *the aims and methods of federal and state agencies are not necessarily identical.*

There are many sides to the argument—the F.P.C., the state commissions, the interstate holding companies and the intrastate operating companies have, and are entitled to, their views—but the old question of states' rights inevitably arises.

"Quoddy" and Maine's Vote

The Passamaquoddy moon-harnessing project is described as an orphan by its critics, but that isn't quite true. It still has its father, the very much alive Dexter P. Cooper; it has only lost (by defection) its godfather, Franklin D. Roosevelt.

And this now-not-too-lusty child is still a live political issue. Maine's Republican Governor, Frederick Hale, still thinks that the project is so meritorious that it should be financed through work relief funds. Home-state projects break down party lines strangely!

Power Pacts Row Ended in Canada

Bill sponsored by T. B. McQuesten, Ontario Minister of Highways, validating contracts between the Ontario Hydro-Electric Power Commission and the Gatineau Power and Maclaren Power companies, both of Quebec, has had its third reading before the Ontario Legislature. It now needs only the royal assent of Lieut.-Gov. Dr. Herbert Bruce to become law, and this is a mere formality. This recent legislative action ended the interprovincial power dispute that started more than a year ago when Premier Mitchell Hepburn's government canceled contracts between the commission and the Ottawa Valley, Beauharnois, Gatineau and Maclaren Power companies, which had been entered into by a previous administration.

Considerable interest is being shown in clause 13 of Schedule "B" to the bill validating the above contracts. The clause which refers to the Gatineau agreement reads: "The commission agrees to observe strictly all Quebec and other laws affecting the exportation, outside of Canada, of the electric power or energy supplied under this agreement." The agreement with the Maclaren company also contains a clause making the contract subject to "the conditions as to export of power to the United States lawfully attached by the Quebec government to its approval of the plans and specifications of the work at Masson and High Falls on the Lievre River."

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Washington Water Power Starts Improving Lines

With the advent of spring the Washington Water Power Company has started several extensions and improvements, including the new 13,000-volt line to Diamond, Wash. The company also is insulating the Colfax-Lind line to carry 110,000 volts insead of 60,000, and increasing the Colfax-Pullman line's capacity to 110,000 volts.

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Rural Lines Rushed

Pressing forward in its rural electrification program, which calls for 2,000 miles of new line this year, Niagara Hudson Power reports 500 miles built in the six months ended April 1 in spite of the handicaps of adverse weather and bad roads.

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Anti-Utility Mayor Loses

Private ownership scored a victory in Fayette, Mo., in this month's primaries when Mayor D. C. Rogers, strong proponent of public ownership, was beaten in his campaign for re-election by former Alderman E. Z. Liggett.

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Co-operative Must Pay Washington Tax

The State Supreme Court of Washington has unanimously held that the State business and occupational tax applies to the Peninsula Light Company, a non-profit co-operative providing power for the Gig Harbor and Peninsula District of Pierce County, McNeil Island, Fox Island and the Allen District. The co-operative, formed in 1935, buys its power wholesale from the city of Tacoma's municipal plant. It has more than 900 members.

The court upheld a lower court judgment dismissing the co-operative's contention that the tax is not applicable to non-profit co-operatives. The company told the court it is a co-operative for the purpose of buying power for its members, but the court held that "the company was not organized and was not engaged in business activities for any moral or benevolent purpose." The tax is 3 per cent on the gross receipts of utilities.

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Nebraskan Advocates State Ownership

Public ownership still looms as the burning issue in Nebraska's elections this year (ELECTRICAL WORLD, February 15, page 43) and Representative Lusienski of Columbus, out for re-election to the Legislature, takes about the most ambitious stand:

He will sponsor, if elected, a bill calling for a constitutional amendment to bring about a state power monopoly.

Black May Seek Public Donations

All Fools Day having passed, what is an appropriate date for a tag day to raise funds for the Senate committee investigating lobbying? The House defeated the resolution to provide $10,000 to fight suits growing out of the committee's "fishing expedition" into private telegrams; now the probers threaten to go to the public for donations to contest such court cases as that brought by Publisher William Randolph Hearst.

The Squire of San Simeon lost the first tilt in his injunction suit (ELECTRICAL WORLD, April 18, page 5), but the issue still is a live one, as the American Society of Newspaper Editors has adopted a resolution protesting against "unreasonable searches and seizures."

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New Utility Taxes Lose in Alabama

A new note entered into utility tax arguments a few days ago when Alabama's Lieutenant-Governor Thomas E. Knight led the opposition to pending levies on light and power companies, questioning why private utilities should be penalized with heavy imposts when T.V.A. was allowed to escape. Two pending utility taxes were promptly shouted down in the Legislature.

The argument arises from the recent revelation that T.V.A. last year paid Alabama $19,600 in taxes and Alabama Power paid $480.000. Reports now are current around the legislative halls in Montgomery to the effect that Attorney-General Albert Carmichael shortly will institute court action to see what additional tax revenue can be got from T.V.A.

Stockholder Prays for His Company

When Virginia Electric & Power held its annual meeting recently no business of importance was transacted, but the meeting will live long in the memory of the officials present.

Standing in the middle of the board room, surrounded by a handful of company officers, a white-haired Negro—the only one of the 12,000 stockholders present—offered an earnest prayer for the company, its employees, and the community. Never before in the company's history—perhaps in any Richmond company's history—has such a prayer been made by a stockholder.

The Negro, Freeman Harris, served Virginia Electric for 43 years as a track greaser and has been pensioned for some time past. As the meeting was called to order he told President Jack G. Holtzclaw he could not stay long, that he had to attend a meeting of his church's deacons. When his time became short he asked the privilege of the floor and simply, sincerely expressed his appreciation of all the company had done for him. Then came the prayer, straight from his heart.

All present bowed their heads with the aged Negro.

Engineers Attack Government Dams

Fowle tells Middle West Conference federal power developments are uneconomic and misplaced — Chase calls works too big for men at helm

"Although the waste of public money in constructing uneconomic and misplaced power development is very serious of itself, perhaps the most serious aspect of these undertakings is the development of surplus power on a scale that seems wholly inexcusable. It cannot be doubted that this surplus will prove irresistible to politicians and radicals. . . . The inevitable results of competition with regulated private industry will be to destroy much of their business and prosperity, promote unemployment and distress, and ultimately ruin thousands of innocent investors."

This is the conclusion of a study on the economic development of the nation's power supply under private enterprise presented by Frank F. Fowle at the Middle West Power Engineering Conference in Chicago this week. "It is cheaper to transmit power in a coal car than by wire," said Mr. Fowle, as he showed that the cost of energy transportation by electric transmission is 2.6 times the cost of transmission as coal in freight cars. In his study Mr. Fowle discovered that a cost of $250 per kilowatt of current hydro capacity is representative of the less costly federal projects. In comparison with a typical cost of $85 per kilowatt of steam plant capacity, he showed that the steam plant would have an energy production cost of less than two-thirds of that of the hydro plant. Speaking of specific projects in the government plan, Mr. Fowle stated that Passamaquoddy, Casper - Alcova, Fort Peck, Tygart and Central Valley are hopelessly uneconomic as power developments. Wilson Dam, Wheeler, Pickwick, Chickamauga and Bonneville, he said, offer some hope of economical results.

The same critical attitude was shown by Frank D. Chase, president, in opening the conference. He stated that engineering opinion is 99.44 per cent unanimous that in its public works program the government has on its hands a job that is too big for it, and that some way in which engineers must help work out a national plan of handling this gigantic public operation must be established to prevent the waste of further billions. He stated that the very important functions of engineering determination are "in the hands of men who could not tell a turbine from a concrete mixer."

The paper by Dr. A. E. Morgan, T.V.A. chief, presented in his absence by George M. Hamilton, was not in any sense an engineering discussion. Instead it was a statement of the high ideals of T.V.A. As has become the fashion lately, the paper treated power as incidental to navigation, flood control, soil improvement and other amiable purposes of social rather than economic significance. No other projects than those included in the T.V.A. program were even mentioned.

In the session devoted to "power economics" was painted a broad picture of the trend in research in power plant and electricity system development. Mr. Hirshfeld said that the availability, already very extensive, of materials for use at high temperatures and pressures would be much enlarged and that developing practices in power plant design now being tentatively or experimentally applied would undoubtedly result in lower power costs. William A. Hanley spoke on the interchange of power and steam between industry and public utilities.

COMING MEETINGS

Missouri Association of Public Utilities—Annual meeting, St. Louis, Mo., April 29-May 1. Jesse Blythe, assistant secretary, Merchants Bank Building, 101 West High Street, Jefferson City, Mo.

Southeastern Electric Exchange — Annual conference, Fort Sumter Hotel, Charleston, S. C., April 30-May 1. J. W. Talley, executive secretary, 308 Haas-Howell Building, Atlanta, Ga.

Maryland Utilities Association—Annual meeting, Lord Baltimore Hotel, Baltimore, Md., May 1. W. J. Lank, secretary, Pepco Building, Tenth and E Streets, Northwest, Washington, D. C.

National Electrical Wholesalers Association — Annual convention. The Homestead, Hot Springs, Va., May 4-9. E. Donald Tolles, managing director, 165 Broadway, New York.

American Institute of Electrical Engineers—North Eastern District Meeting, New Haven, Conn., May 6-8; summer convention, Huntington Hotel, Pasadena, Calif., June 22-26. H. H. Henline, national secretary, 33 West 39th Street, New York.

Northwest Electric Light and Power Association—Annual general meeting, engineering and operation section, Davenport Hotel, Spokane, Wash., May 7-9. Berkeley Snow, executive secretary, Spalding Bldg., Portland, Ore.

Refrigerating Machinery Association—Spring meeting, Hot Springs, Va., May 14-16. D. Norris Benedict, president, 915 Southern Building, Washington, D. C.

Air Conditioning Manufacturers' Association — Annual meeting, Hot Springs, Va., May 16. P. A. McKittrick, president, 915 Southern Building, Washington, D. C.

National Electrical Manufacturers Association — Spring meeting, The Homestead, Hot Springs, Va., May 17-21. W. J. Donald, managing director, 155 East 44th Street, New York.

National Battery Manufacturers Association — Spring convention, Statler Hotel, Cleveland, Ohio, May 20-21. W. J. Parker, 7 East 44th Street, New York, N. Y.

Edison Electric Institute—Annual convention, Municipal Auditorium, St. Louis, Mo., June 1-4. Bernard F. Weadock, managing director, 420 Lexington Avenue, New York, N. Y.

Third World Power Conference—Washington, D. C., September 7-12. Joel Wolfsohn, executive secretary, Interior Building, Washington, D. C.

Optimism Marks Coast Meeting

New vitality and aggressive confidence characterized the two-day annual spring conclave of the Pacific Coast Electrical Association at Fresno, Calif., attended by more than 250, representing an unusually wide cross-section of the electrical industry as a whole. The enthusiasm and optimism which was evident on every hand more than justified the recent decision of the association to expand its activities during the coming year.

Delegates were officially welcomed by A. Emory Wishon, president of San Joaquin Light & Power, in whose building the meetings were held, and by F. O. Dolson, president of Southern Sierras Power and retiring president of the P.C.E.A.

The first order of business was the reading of the prize-winning papers, chosen from those submitted by 744 contestants, on the eight problems placed before the membership last December. The remaining sessions were devoted to presentations by each branch of the industry tending to promote mutual understanding and better co-ordination of activities to the end of greater electrical development.

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International Society to Meet in Holland

Plans have been completed for the Congrès International pour les Applications Electro-calorifiques et Electro-chimiques, under the auspices of the International Union of Producers and Distributors of Electric Energy, in Scheveningen, Holland, June 12 to 15. While these dates cover the main business sessions, arrangements have been made for meetings, field trips and a three-day excursion on the Holland-America Line's flagship, the *Statendam*, for delegates who choose to spend the two weeks from June 10 to 24 in Scheveningen.

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Mid-West Engineers Meet

Engineers from Missouri, Kansas, Nebraska and Iowa met recently in Kansas City, Mo., in the eighth annual engineering conference and parallel meetings of the power sales conference of the Missouri Valley Electric Association. About 250 were in attendance.

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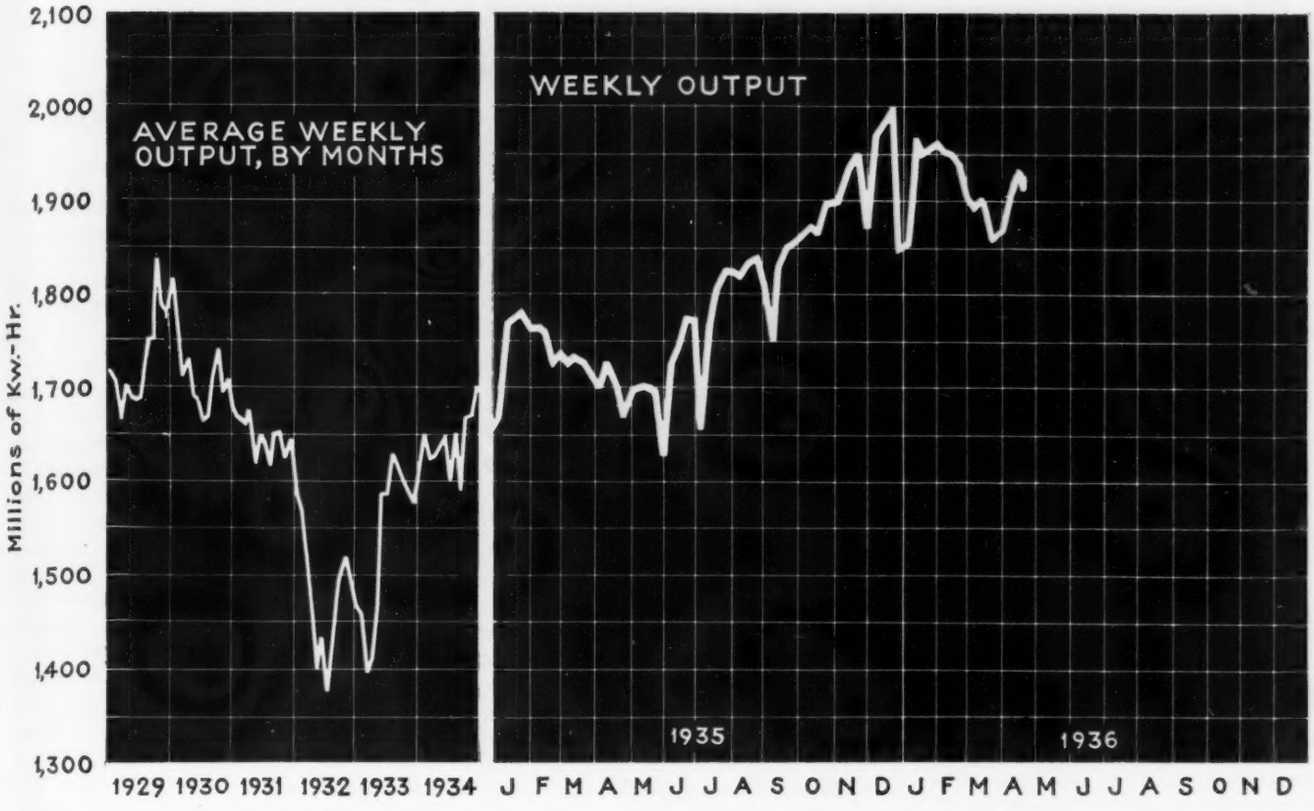
Engineers Meet in May

A trip to Grand Coulee is to be a feature of the thirteenth annual convention of the engineering and operating section, Northwest Electric Light and Power Association, in Spokane from May 7-9.

Output Maintains Strong Lead Over 1935



Energy output for electric light and power is maintaining its lead over previously established records for this time of the year. For the week ended April 18 it amounted to 1,914,710,000 kw.-hr., according to the Edison Electric Institute, and for the third consecutive week exceeded corresponding figures for 1935 by more than 12 per cent. Except during March the lead over last year has not only been maintained but has tended to increase somewhat since the middle of January. Resistance to the usual drooping characteristic of the output curve is even more evident when comparison is made with the first half of 1930, which thus far has had the largest production for the January-June period, though it was closely approached in 1935.

In the Middle Atlantic states and the South gains of 10 per cent or more over last year, and in the Mountain states of 15 per cent or better, have prevailed for several months. These gains are being maintained. In New England a rise to 14 per cent restores the rate reported last fall. The Coast is up to 16.5 per cent.

Per Cent Change from Previous Year

Region	Week ended Apr. 18	Apr. 11	Apr. 4
New England.....	+13.9	+11.2	+ 7.2
Middle Atlantic...	+10.0	+ 9.8	+13.0
Central Industrial.	+12.3	+13.2	+13.6
West Central.....	+11.5	+ 8.1	+10.0
Southern States...	+11.7	+12.7	+12.0
Rocky Mountain..	+15.8	+18.2	+16.9
Pacific Coast.....	+16.5	+12.2	+13.6
United States...	+12.5	+12.1	+12.7

Weekly Output, Millions of Kw.-Hr.

1936	1935	1934
Apr. 18... 1,915	Apr. 20... 1,702	Apr. 21... 1,673
Apr. 11... 1,934	Apr. 13... 1,725	Apr. 14... 1,642
Apr. 4... 1,916	Apr. 6... 1,700	Apr. 7... 1,617
Mar. 28... 1,867	Mar. 30... 1,713	Mar. 31... 1,666
Mar. 21... 1,862	Mar. 23... 1,725	Mar. 24... 1,658
Mar. 14... 1,901	Mar. 16... 1,728	Mar. 17... 1,650

February Output Up 14.6 per Cent

The penalty imposed upon hydro-electric plants by unusually cold weather last winter was apparent in smaller output by such stations in February, whereas steam generation was expanding sharply to make possible the record of 7,988,275,000 kw.-hr. for the month, a report by the Edison Electric Institute indicates. The output figure is 14.6 per cent above the 6,969,101,000 kw.-hr. in 1935; steam generation increased 26.3 per cent and hydro was off 3.4 per cent.

All classes of electricity sales were higher during February, domestic rising 10.6 per cent over a year ago and power sales 13.2. Revenues, however, rose only 5.4 per cent to $171,219,500 from $162,469,900.

For the twelve months ended February 29 there was a rise in residential consumption to an average of 683 kw.-hr. from 637 in the preceding year; the average rate dropped to 4.96 cents from 5.62 and the average bill rose to $2.82 from $2.79.

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Maryland Defeats Tax on Utility Gross

When taxes are *not* imposed upon public utilities, that's news! Hence this story.

In Maryland's recent legislative session there were a lot of measures to raise money for relief, and not a few of them concerned public utilities. One plan was to tax utility gross at from 1 to 2 per cent. It was about as bitter a fight as the House of Delegates has ever seen, but all efforts to saddle new taxes on utilities failed.

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New Public Power District

First steps in the organization of the Republican River public power and irrigation district in the state of Nebraska were recently taken with the election of a board of directors of nine members, three each from Webster, Nuckolls and Franklin counties. These men will have charge of securing the necessary petitions from the voters in the district. After this is completed, a president and secretary will be elected and application made to Washington for the loan.

Utility Stocks Lose Ground

Following the trend of the general list, light and power stocks weakened this week and drifted to lower levels. "Electrical World" index, 35.8; last week, 37.1.

Canadian Loan Features New Issues

A $40,000,000 financing operation by the Saguenay Power Company, Ltd., to provide funds for refunding purposes was carried out this week in the United States and Canada with the offering of $30,000,000 of first mortgage 4¼ per cent bonds, $5,000,000 of 2¼ to 4 per cent serial notes and $5,000,000 of 5½ per cent cumulative preferred shares.

The offering in this country consisted of $25,000,000 of first mortgage 4¼ per cent bonds, series A, due on April 1, 1966, and $5,000,000 of 2¼ to 4 per cent serial notes, due June 15, 1937 to 1946, both payable in United States dollars. The securities that will be offered in Canada simultaneously include $5,000,000 of the first mortgage 4¼ per cent bonds, designated as series B, and $5,000,000 of the 5½ per cent cumulative preferred shares of $100 par, both payable in Canadian dollars. Net proceeds from the sale of these securities, together with other funds of the company, will be used to redeem on July 1 at 104½ all outstanding $35,269,000 of Duke-Price Power Company, Ltd., first mortgage 6 per cent bonds due in 1966 and for the prepayment or redemption at par not later than July 1, 1936, of approximately $1,930,000 of the company's 6 per cent notes, originally due in 1932 and extended to 1938. Both of the issues to be redeemed are payable in United States dollars. Saguenay Power was originally incorporated under the name of Duke-Price Power Company, Ltd. It owns and operates a hydro-electric generating plant on the Saguenay River, in Quebec.

The $10,500,000 first mortgage bond issue of the Wisconsin Gas & Electric Company was put on the market this week and was priced at 101½ per cent and accrued interest. Net proceeds from the sale of these bonds, together with treasury funds of the company, will be applied to the redemption on June 1 of $9,900,000 of outstanding first mortgage, series A, 5 per cent bonds, due June 1, 1952, at a price of 105 and interest.

New York State Electric & Gas Corporation has filed an amendment with S.E.C. postponing the offering date of its $17,500,000 of 4 per cent first mortgage bonds to May 11 from April 21.

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Consolidated Edison Plans to Drop Quarterly Reports

Quarterly earnings statements by companies in the Consolidated Edison (formerly Consolidated Gas) of New York system are to be abandoned with the forthcoming report and, in their place, twelve-month statistics will be made public at quarterly intervals. This accounting practice is now followed by American Telephone & Telegraph and is supported by many who feel that quarterly statements, which emphasize seasonal swings in business, are not representative.

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Quebec Commission Asks for Property Valuations

Quebec's new regulatory commission has ordered all power companies in the province to submit, within 60 days, as complete details as possible about quantity, nature, capacity, location and value of equipment (initial cost and depreciation) for rate-making purposes. The commission states that it is not its intention now to ask "public services to undertake extended inventories and appraisals," but "that its future policy will be determined to a large extent by the nature of the available information."

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Uniform Reports Still a Problem

After a full week of discussion on utility accounting practices, representatives of the utilities and of the state regulatory commissions departed from Washington with the feeling that all is not roses, but that much progress had been made in evolving a single system of accounts to satisfy the requirements of all regulatory bodies.

For more than a year representatives of a number of federal departments in collaboration with the committee on statistics and accounts of the National Association of Railroad and Utilities Commissioners, headed by Dr. Edward W. Morehouse of Wisconsin, have been working to evolve one comprehensive system of accounting which would serve all needs. Last December the Federal Power Commission issued a tentative draft which was widely distributed for criticism. On April 13 a meeting in Washington was opened to hear criticisms and suggestions from all parties concerned. Pending the thorough digestion of this material, no announcement will be made.

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Liquidation Proposed for Western Power

Plans for retirement of Western Power Corporation's preferred stock through sale of 98,600 additional common shares at $100 and distribution of assets (1,122,060 shares of Pacific Gas & Electric common) to owners of the junior shares (North American Company owns 99.88 per cent) will be considered at a special meeting April 30.

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Iowa-Nebraska Light to Build New Plant

The first step in Iowa-Nebraska Light & Power's expansion program in Iowa will be construction of a new $250,000 station at Red Oak, the company announces. Work is to begin May 1, according to the plans, and the new plant will serve several Iowa cities now receiving energy from the company's Lincoln, Neb., plant.

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To Exercise Option

Engineers Public Service plans to exercise on April 28 its option on 92,119 shares of El Paso Natural Gas common stock (now held in escrow) at $25 a share.

MANUFACTURING AND MARKETS

Editors Inspect Bethanized Wire

Something new in wire was formally announced last week when the Bethlehem Steel Company took 35 editors, metallurgists and university professors through the Cambria plant, Johnstown, Pa., and told them the story of "bethanizing" or electroplating wire with zinc in what the steel company regards as a big improvement over the hot-dip galvanized method. It was pointed out that a principal application at first will be in fence wire, but that many other types will be produced by the new process—that some already is being tested in communications and that the utilities will also be invited to study the product.

Bethlehem contends that the bethanized wire can be produced as cheaply as the prevailing galvanized, that it has greater resistance to corrosion and mechanical injury in bending and tension. The electroplating plant, which was declared open officially simultaneously with the tour, is a giant unit with two plating cells 110 feet long and taking 40,000 amperes at normal load from a huge homopolar generator.

After the morning tour of the plant the steel company's guests were entertained at luncheon at the Old Country Club. L. H. Winkler, a Bethlehem Steel metallurgist, spoke on the applications and utility of the new product and U. C. Tainton, electrometallurgist of Baltimore, told of the basic theory involved in the process, which leaches pure zinc directly from the ore and deposits it on the moving wire.

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"New American" Home Committee Appointed

The committee to manage the 1936 "New American" demonstration home-building program for the New York metropolitan area and territory as far north as Poughkeepsie is headed by J. O. Wetherbie, Eastern manager of building equipment sales for the General Electric appliance and merchandise department. Others on the committee include:

M. D. Grow of Rex Cole, Inc.; Ralph Hansberger of Gene Meenan, Inc.; A. L. Hart, Patchogue, L. I., air-conditioning dealer; C. M. Schwerin of Schwerin Air Conditioning Corporation; H. N. Van Cleaf, G. E. air-conditioning department in New York, and H. C. Callahan, district head G. E. Supply Corporation.

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Philippine Market for Equipment Growing

Growing use of electricity in the Philippines over the last several years has resulted in larger imports of electrical machinery, apparatus and appliances, according to a report to the Department of Commerce from Trade Commissioner J. Bartlett Richards in Manila. Mr. Richards reports 1935 imports of $2,153,668, with the United States getting 86.4 per cent of the business. The United States has almost the entire market for electric fans; it gets most of the insulated wire business, but Japan has been showing a steady increase in cheap wire and fixtures.

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Electromaster Reports Sharp Sales Increase

Sales of Electromaster Inc. in the first quarter of 1936 approximately doubled the volume of the initial three months last year, March broke all records in the company's history dating back to organization in 1929, and the prospects for the balance of 1936 are excellent for both electric ranges and electric water heaters, according to Gerald Hulett, vice-president. Mr. Hulett made this statement following the recent annual meeting.

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Cooke Sees R.E.A. Aiding Manufacturers

Many protests have been sent to the Rural Electrification Administration against the agency's policy of urging the farm "co-ops" to buy appliances and wiring supplies as a group. Now comes R.E.A.'s chief, Morris L. Cooke, to tell manufacturers and contractors that this program should be a challenge to their salesmanship, not a source of fear.

Mr. Cooke, in a letter to G. M. Haskell, chairman of the National Electrical Manufacturers Association's rural electrification committee, declares that rural electrification through government aid should prove a boon to manufacturers.

•

Air-Conditioning Orders Show Gain in February

Orders for air-conditioning systems and equipment in February reached a value of $2,611,241, against $2,313,534 in January, according to reports by 98 manufacturers to the Department of Commerce. Statistics on February, 1935, are not available as the department began to compile its records this year.

EDITORS SEE NEW BETHANIZED WIRE

Representatives of agricultural, technical, business and general publications visited Bethlehem Steel's new mill at Johnstown, Pa., toured the plant, heard about the new product and the electrolytic process for its plating.

Manufacturers' Net Higher for Quarter

New evidence of returning prosperity in the electrical equipment field comes to light in first quarter financial statements, which are now making their appearance. Westinghouse Electric & Manufacturing, for example, reports net income for the three months of $3,732,454, equivalent to $1.40 a share on the combined preferred and common stock issues, compared with $2,326,496, or 87 cents a share, in the corresponding 1935 period. This showing was made in the face of damage and delay experienced during last month's floods.

Westinghouse recorded the best bookings in the first quarter since the three months ended June 30, 1931. The total was $42,515,469, against $30,762,901 in the corresponding 1935 quarter and $44,828,000 in the second quarter of 1931. Central-station equipment contributed about $10,000,000 to orders, a gain of more than 100 per cent.

Similar advances mark General Electric's showing. Net sales billed were $51,423,071, compared with $40,393,538 in the first quarter last year. Net income was $7,086,830, against $5,390,931 in the 1935 period. The company also reported for the twelve months ended March 31, net sales being $219,762,966, against $170,255,304 in the preceding year, and net income $29,539,671, against $18,619,940.

Apex Electrical Manufacturing's first quarter resulted in net earnings of $114,392, against $59,369 in the like 1935 period.

•

Kitchen Campaign Launched

Birmingham's newly organized Kitchen Modernizing Bureau has elected as its first president R. P. McDavid. The initial meeting heard a talk by H. L. Martin of the national bureau.

•

I.E.S.-Beaux Arts Prize in Illumination Awarded

James Harrison Finch of the Georgia Technical Institute won the $500 top prize in the fifth competition sponsored by the Illuminating Engineering Society and the Beaux Arts Institute of Design, New York. This year's problem was to design an automobile salon with particular attention to lighting.

•

Enlarged Range Program

Substantially increased activity in electric range manufacturing is announced by the A-B Stove Company of Battle Creek, Mich. The line has been enlarged and the company has embarked on a vigorous sales program.

•

Range Sales Top Quota

Completion of the first 1936 major appliance campaign finds Georgia Power Company over the top in range sales with a total of 977 units, against a quota of 750. The range campaign ran from February 17 to March 25.

New York Metal Prices

	Apr. 15, 1936 Cents per Pound	Apr. 22, 1936 Cents per Pound
Copper electrolytic	9.50*	9.50*
Lead, Am. S. & R. price	4.60	4.60
Antimony	12.75	12.50
Nickel ingot	35.00	35.00
Zinc spot	5.275	5.275
Tin Straits	47.125	46.375
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley

Field Reports on Business

Reports to ELECTRICAL WORLD *from observers in the field indicate that the first month of the second quarter will prove the best of the year to date, with practically all lines of industry prospering. The business upturn, however, gives some indication of leveling off at the moment. Nevertheless, current operations definitely are at the best level of the depression and politics causes little uneasiness.*

NEW ENGLAND

Power equipment sales led in orders for electrical supplies and apparatus in this district last week. Small motors are in steady demand with orders well ahead of last year and switch and control apparatus are maintaining a very encouraging pace. In addition to the strong trend in motor sales, reconditioning crews are busy on rehabilitation. General Electric is working overtime at Lynn. Jobs range from machine motors to textile motors.

Engineering studies of several power equipment projects involving small turbogenerators are engaging the departments of heavy power equipment manufacturers, though orders are being withheld for the present.

Central station supply orders are spotty; line materials are gaining in activity and wire and cable demand is quite heavy. One manufacturer reports but little let-down in the movement of service meters. Construction of residences is active in suburban districts and air conditioning is receiving encouraging attention. Electric range sales in eastern Massachusetts are gaining. In Vermont 150 electric refrigerators were sold in the last two weeks. Allotments for repairing damage due to flood amounting to approximately $750,000 have been announced.

CHICAGO

Business extended its advance last week as general activity reached the highest level since the first of the year. Increases in steel and auto production and power sales all contributed. Although retail activity in Chicago declined in the usual post-Easter recession, turnover was materially ahead of 1935. Several new building projects in the city were announced. Two electrical manufacturers are building new factories. Construction in Chicago during March increased 153 per cent over February, while in the suburban area the increase amounted to 282 per cent.

New records are expected this spring in the sale of major household appliances; reports for the first quarter show gains of from 15 to 30 per cent. Manufacturers report orders for electrical equipment better than during the first quarter. Contract will be awarded this month on a local P.W.A. project involving motors, control devices, transformers, switches, signals, lighting fixtures and wire and cable amounting to the sum of $150,000.

NEW YORK

Optimism prevails in most lines of business, inspired by good first-quarter earnings reports and further industrial expansion thus far in the second quarter. It appears that April's sharp upturn has lost a little of its momentum, however, as steel output has flattened out (at the highest mark of the recovery) and power production has dipped moderately even though increasing its margin over a year ago to a full 12½ per cent.

Reports from the automobile industry continue rosy; motors and the railroads are providing the bulk of steel business at the moment. Carloadings hold a wide margin of improvement over last year and Eastern carriers report the outlook bright for both passenger and freight revenues for the first half of the year.

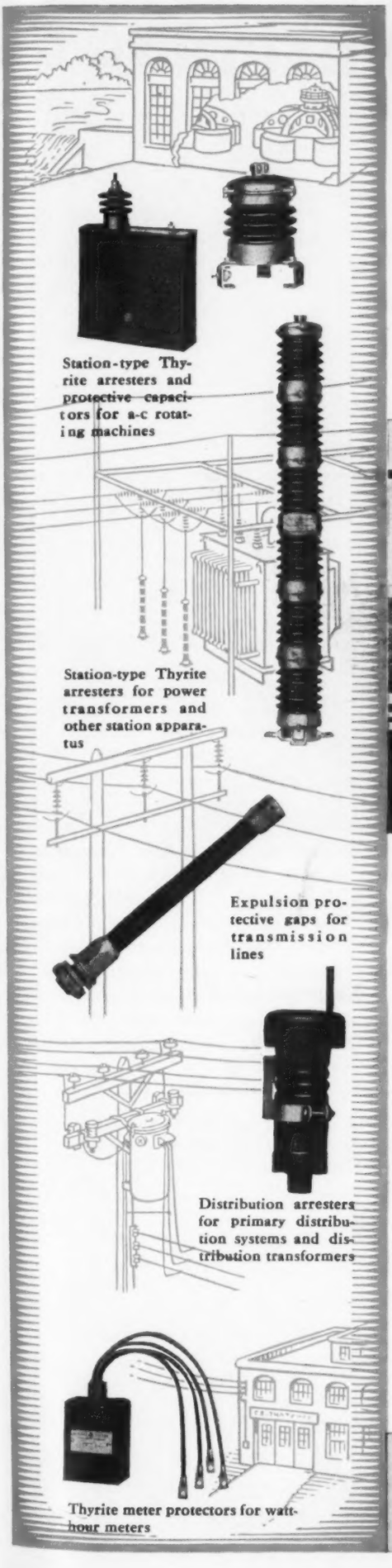
There is enough talk of impending utility orders for generating equipment almost to indicate that Congress were not in session; enough to forecast substantial expansion at the slightest reassuring political gesture.

PACIFIC COAST

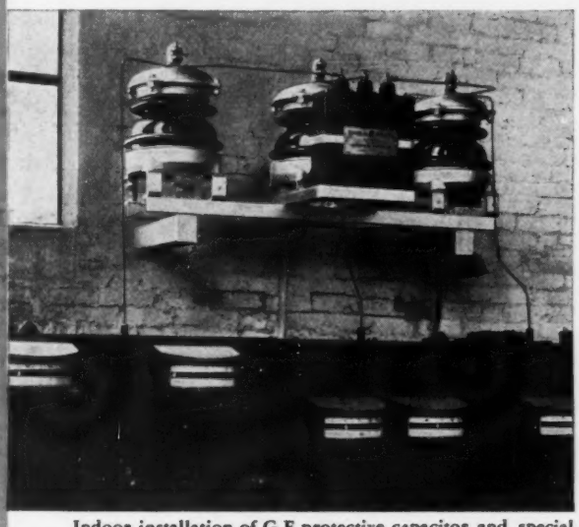
After a ten-day tieup, which is estimated to have cost San Francisco alone $2,000,000, the striking longshoremen have accepted arbitration and thus averted disaster for the Coast's shipping industry.

The recent quarter-cent increase in bare and weatherproof copper wire accounted for about 40 carloads in California. Small cities, such as Sacramento with an 800 per cent gain in first quarter building permits and Eureka with 1,700 per cent, lead the rise in home building. Blocks of 25 to 50 houses in Burbank and San Jose are other examples, but many of the jobs are at such low figures that sales of standard wiring material are far from commensurate. Moreover, owners' insistence on disproportionate bathroom expenditures shows that the electrical industry has not yet put over its message on wiring.

Departmental officials for the bridge exposition have been appointed and the electrical industry favors taking a building rather than allowing scattered exhibits. Spectacular lighting is proposed. Local firms expect to bid on several millions of dollars of exposition work. The $425,000 Salinas courthouse and the $350,000 state office building in Sacramento feature central California construction; schools and colleges stand out in the south.


Station-type Thyrite arresters and protective capacitors for a-c rotating machines
Station-type Thyrite arresters for power transformers and other station apparatus
Expulsion protective gaps for transmission lines
Distribution arresters for primary distribution systems and distribution transformers
Thyrite meter protectors for watt-hour meters

G-E Protective Capacitors and Arresters PREVENT *Lightning* STRESSES on Your A-c Rotating Machines



Indoor installation of G-E protective capacitor and special station-type Thyrite arresters connected to station bus for protection of 2400-volt generators

YOUR rotating machines are the key to the service continuity of your system.

They merit the *modern* protection against lightning—three-fold protection which:

(1) Limits the surge amplitudes.
(2) Slopes off wave fronts.
(3) Prevents dangerous reflections within the machine windings.

This results in greatly increased security against machine failures from lightning voltages.

G-E protective capacitors, in combination with special station-type Thyrite arresters, will provide this complete protection at a cost which is small when compared with the repair expense of even a single machine failure—insignificant when compared with the investment in your rotating machines. For complete information, ask for Bulletin GEA-1304C. General Electric, Schenectady, N. Y.

COMPLETE LIGHTNING PROTECTION FROM THE GENERATOR TO THE METER

330-247

GENERAL ELECTRIC

FIELD OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Simpler Switching for Interchange

A 75,000-kva. interconnection between two Eastern power companies involved so much expense for switching facilities at one end of the tie line that an extended analysis was made to determine how simple a layout could be provided to meet the requirements without undue sacrifice of flexibility.

In the first layout (Fig. 1), each three-phase transformer was available for service on either of two 110-kv. or two 13.8-kv. buses by using a separate automatic breaker for each bus tap. The layout was an example of orthodox switching and embodied complete operating flexibility, but its costliness is indicated by the 21 circuit breakers and related dsconnects, insulation, control facilities, etc.

The second plan (Fig. 2), which was adopted, represented a moderate compromise between the high investment cost of Fig. 1 and a somewhat less flexible arrangement at much lower outlay. It involved the use of only thirteen circuit breakers and related equipment. To offset the disadvantages of the unsymmetrical arrangement of transformers shown, at least in part, it was provided that transformer *A* and transformers *B* and *C* (the latter grouped together) could be operated on either 13.8-kv. generator bus by the use of selective circuit breakers. On the 110-kv. line the tie breaker greatly increased the operating flexibility of the system.

The adopted scheme is subject to some limitations, although these can be overcome to some degree by other interconnections existing between the two companies. In case of a failure of circuit breaker *g* no means is shown of utilizing transformer *A* (rating 25,000 kva.) until the breaker is restored to service. If the local situation warrants the use of by-passing air-break switching at *g* or if a disconnecting switch could be provided to throw transformer *A* on circuit No. 2 of the outgoing line after the manner indicated on the high sides of transformers *B* and *C* this large amount of step-up capacity would be maintained in service during the period of breaker *g*'s outage. Even more important would be a breaker by-pass switch at *h*. It would also seem advisable if possible to provide some means of disconnecting the low-tension side of transformers *B* and *C* from each other in case of trouble in either. This might be done by disconnects in the lower voltage connections at point *l*, opening such switches only after the breakers *h* and *e* are open, after which the unaffected transformer could easily be replaced in service on circuit No. 2.

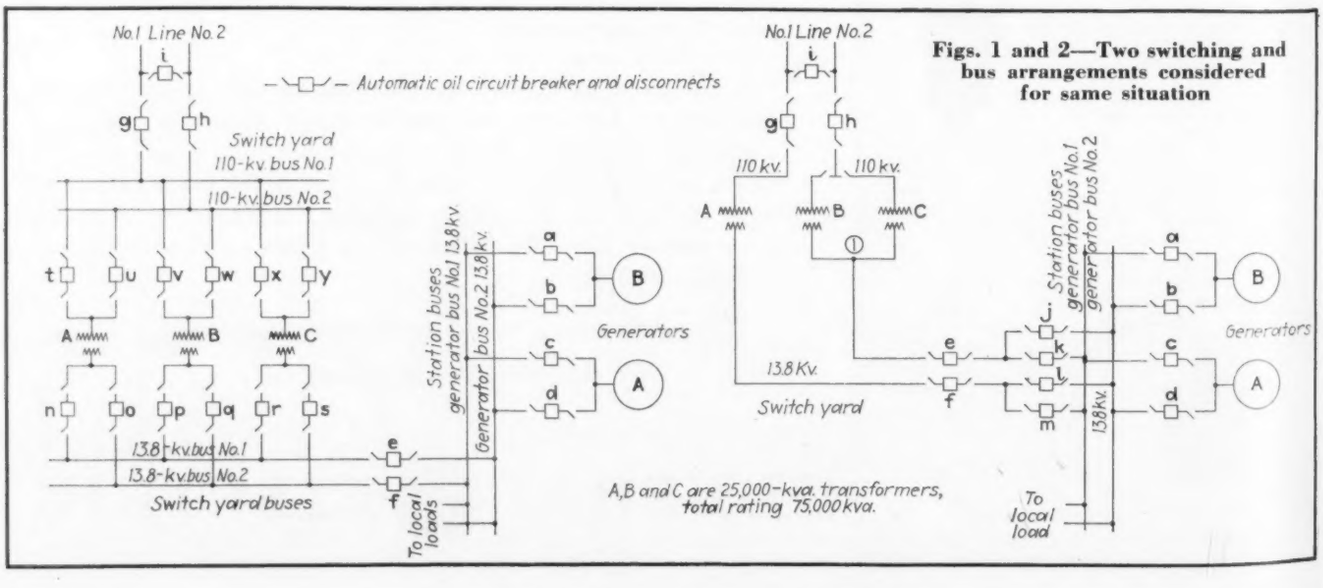
Another handicap is the removal from service of the two transformers *B* and *C* with 50,000 kva. capacity in case breaker *e* fails. Here again some by-pass connection would appear desirable at *e*, and the same point could be made at breaker *f*. With these exceptions, remedies for which do not appear unduly expensive, the simpler plan of Fig. 2 provides a remarkable degree of flexibility for so drastic a reduction in breaker equipment and bus connections.

•

Covering Up the Meter Jumper

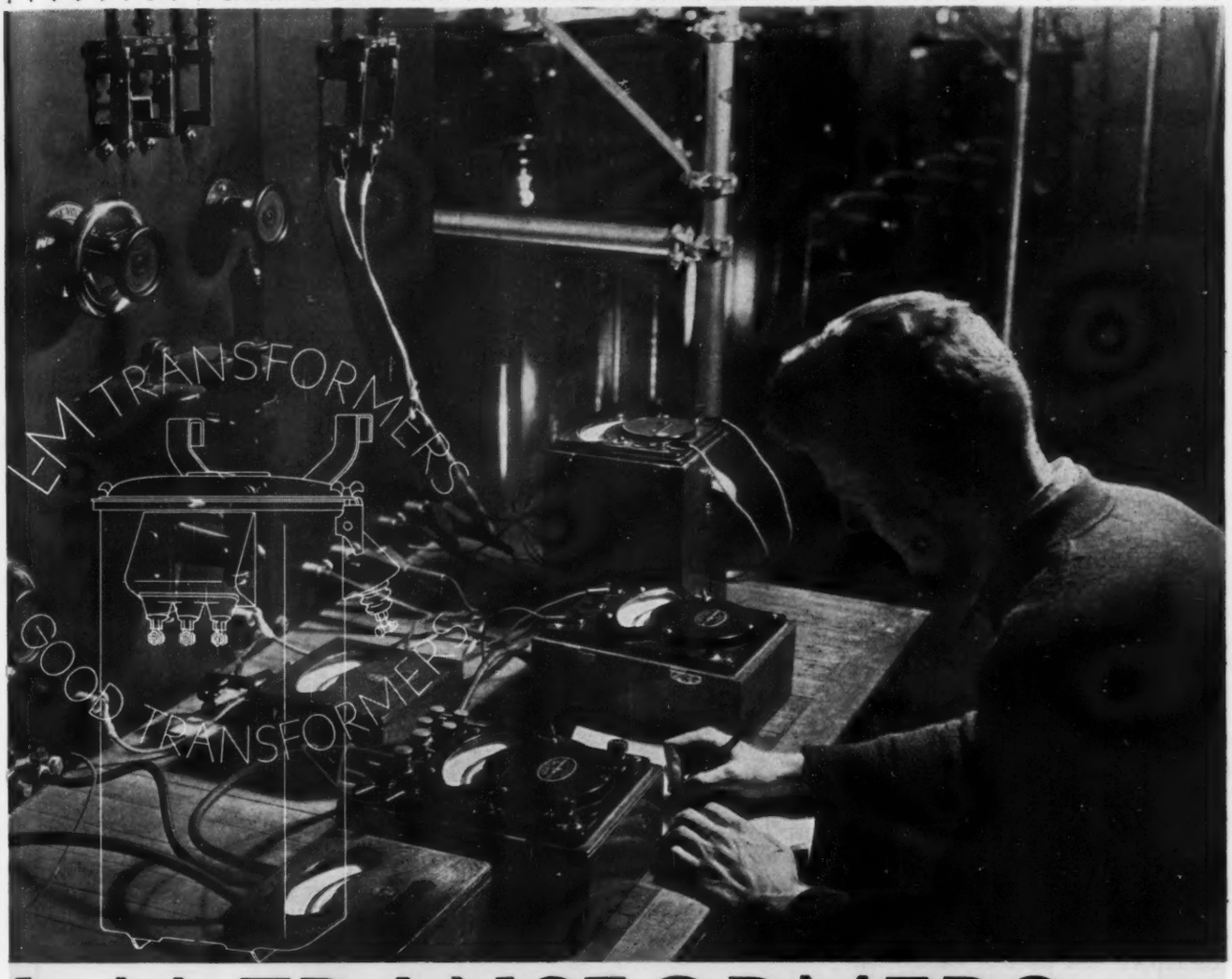
"You want'a read the meter, huh? Somebody's hung his overalls over it. Lemme take 'em down. There it is. Read it right, now."

Words like these and the condition they describe greeted the meter reader several times in succession as he entered the premises of a customer of the Kansas Electric Power Company at Parsons, Kan. It began to look rather funny that the same suit of overalls should be hung over the meter month after month. Investigation disclosed that the garments covering the meter were doing more than just hanging there. A meter "jumper" was sewn



Figs. 1 and 2—Two switching and bus arrangements considered for same situation

. . . . . CARRYING OUT ONE OF THE STANDARD ROUTINE TESTS ON L-M TRANSFORMERS . . . . . .



L-M TRANSFORMERS ARE RIGIDLY INSPECTED—CAREFULLY TESTED

Inspection of L-M Transformers starts with the raw material and follows through every step of the assembly. Workmanship is methodically watched and checked.

The finished transformers are carefully tested in accordance with the standards of A. I. E. E. and N. E. M. A. The test characteristics of every transformer are filed.

Every diligent effort is made to assure that L-M Transformers have uniformly high quality—give reliable service.

More reasons why "L-M TRANSFORMERS ARE BETTER TRANSFORMERS."

LINE MATERIAL CO.

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Type of fault	B-g-to-gd.	BC-g-to-gd.		
Cycles duration	10	12	Total	22
Seconds duration	0.20	0.24	Total	0.44
PPS bus volts	100	77	Min.	77
NPS bus volts	12	19	Max.	19
AB bus volts	101	94	Min.	94
BC bus volts	90	62	Min.	62
CA bus volts	111	79	Min.	79
Fault line amperes	4200		Max.	
Fault ground amperes	4200	3300	Max.	4200
B-g line amperes		4940		
C-g line amperes		4780		

STATION	Relay operation	Relay phase target	Relay time cyc.	Relay time sec.	Breaker operations	Breaker time cyc.	Breaker time sec.	Breaker arc cyc.	Interrupted kva
D.S.-5	CO	B			No. 9 and 10	22	0.44	1.3	272,000

Form expedites transmittal of information gained by oscillograph operations
Data from an automatic oscillograph operation. Details relative to the actual fault period derived from analysis of the record obtained in the case of fog flashover of insulator or pole top switch.

into the coat of the overalls in such a manner that it was held tightly in place when the garment is hung over the meter. Then when the courteous and apologetic customer removed the coat so the meter reader can see the dials the "jumper" came away with it.

•

Oscillograph Reports Aid Fault Analysis

By THEO. M. BLAKESLEE
Los Angeles Bureau of Power & Light

A printed form for automatic operation reports now used by the Los Angeles Bureau of Power and Light greatly expedites the making of oscillograph reports of faults, relay tests, etc., and permits economies in film rolls used. At the same time it conveys all pertinent information obtainable from the oscillograph records themselves.

Experience gained over a period of years demonstrated that records of the usual system disturbance produced certain definite information such as the duration of the trouble, its severity as indicated by the drop in station bus voltage, the time for breaker clearings, the unbalance incident to the disturbance and the ground or fault currents. If these details are presented in a conventional written report considerable needless effort in duplicated wording is required. The printed form shown in the illustration provides for convenient tabulation of the more or less routine features of the fault records and yet has ample space and flexibility for reporting any unusual details or for presenting any discussions necessary to the explanation of the record.

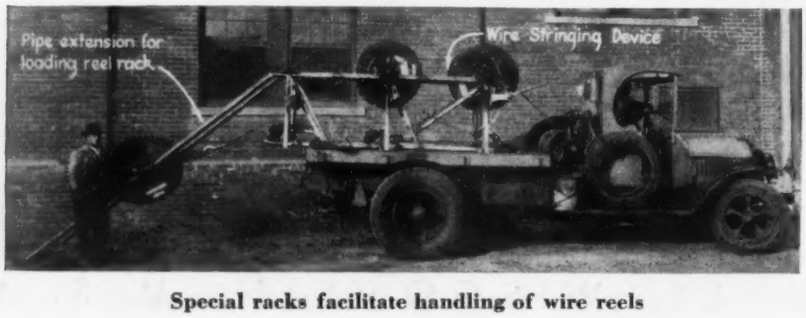
Use of these forms eliminates the costly reproduction of the general run of the oscillographic records and yet enables the information to be distributed among all interested parties in the organization.

•

Extension for Loading Reels

By CARL R. WENZ
Assistant Superintendent of Construction, Oklahoma Gas & Electric Company

As an added refinement to the convertible wire-stringing and rewinding device which is used by this company a detachable loading extension protects against damage to returnable wire reels and greatly facilitates the loading of full wire reels. This extension consists of two pieces of pipe which are slipped over the ends of the stringing rack to support the wire reel while it is being hoisted into position by the truck winch. The extension is carried underneath the truck bed.

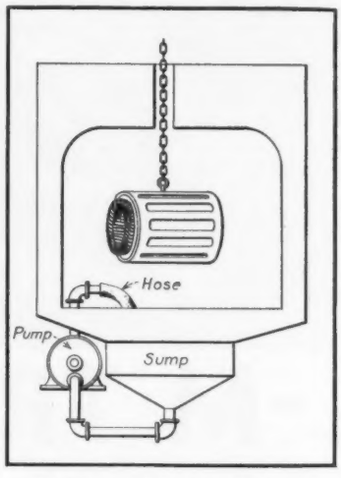


Special racks facilitate handling of wire reels

•

Safety and Speed in Motor Washing

Every motor that for any reason is removed from service and enters the winding shop of Chevrolet plant No. 7 at Flint, Mich., is disassembled. The end bells and rotor are cleaned with a steam hose and the stator is given a bath. Gasoline is about the best and the cheapest solvent for the peculiar kind of grime that accumulates on an electric motor during several years service in the average industrial plant. But gasoline is rather mean stuff to handle and it is mixed with carbon-



Motor washing made easy

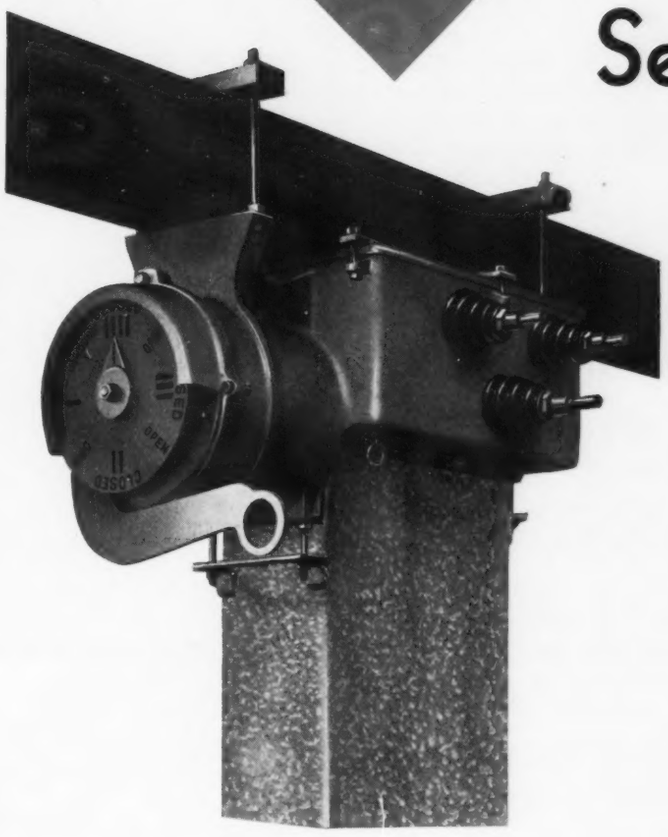
tetrachloride in order to reduce the fire hazard. Also, it is the usual thing to do the washing under some kind of a ventilating hood or in a booth, the motor being set up on a pedestal and the cleaning fluid played on it from a hose. This practice was followed in the Chevrolet shop for a long time and then some one wondered why it was necessary to set the stator on a pedestal. Why could it not be hung from a chain?

The result of these wonderings was the washing booth illustrated in the accompanying sketch. The booth was located at the end of the hand hoist track on which the motors are handled through the shop. The roof of the booth was slotted back to the center to allow entrance of the hoist chain and the removal of the pedestal permitted the cleaning liquid sump to be directly under the motor.

NEW!

PACIFIC
Automatic Service Restorer

For Rural Distribution Lines



GIVING

- **Dependable Protection Under All Weather Conditions**—All operating parts completely enclosed.
- **Three Automatic Reclosures**—Either instantaneous or with adjustable time delay.
- **Simultaneous Opening of All Poles**—Preventing single phase operation of three phase equipment.
- **Low Maintenance Costs**—No skilled attendant necessary—no hot parts to handle—no parts that need replacing—to RESTORE SERVICE.

THE Automatic Service Restorer is intended for pole top mounting on 7.5/12.5 Y kv. systems to provide overload protection with automatic reclosures at pre-determined time intervals. Equipped with expulsion contacts it has a continuous current rating of 100 amperes and an interrupting rating of 1200 amperes. It is easy to install, easy to operate and requires no auxiliary power supply.

The Automatic Service Restorer is available in two and three-pole units to meet all service requirements. It can be set for one, two, or three automatic reclosures.

WRITE
for our new bulletin No. 47

Pacific Electric Mfg. Corp.

5815 3rd St., San Francisco, Cal. **Dunes Highway, Gary, Indiana**

POWER AT WORK IN INDUSTRY

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Heated Patterns Boost Production

Electrically heated foundry patterns being used by a number of foundries in and around Cleveland are said to be the means of saving many dollars for foundrymen by assuring practically perfect molds. Heating the patterns reduces the number of molds spoiled by sand sticking to the plate when the pattern is drawn, according to an article in *Electrical Production*. With a heated plate or pattern, sand in proximity to it is dried, giving a perfect mold even where the pattern has deep draws.

Different types of molding machines require different types of heaters. The most satisfactory arrangement is to build the heaters directly into the pattern. In this way the element is protected from either mechanical or abrasive damage. If the pattern is hollow and screwed into the base plate the heating element can be located between the two or can be built into the base plate. Another method, used where it is not possible to in-set the heaters, is to have the heaters in a separate box and set the pattern over this box when not in use. This warms it up for the next mold. For this type it is best to use a radiant heater as the time over the heaters is usually short.

Operating cost of these pattern heaters is small. Each plate carries two to four small strip heaters conveniently mounted. It has been estimated by several foundries that the electrically heated plates give at least 10 per cent more production, thus more than paying their way.

•

Power Data for Conditioned Theater

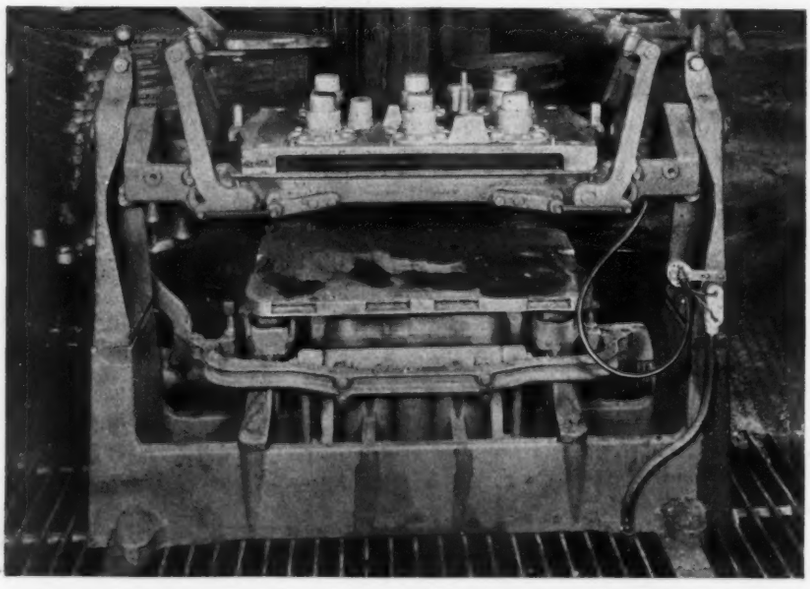
Two years' operation of an air-conditioning plant in a New England theater seating 3,000 persons resulted in a total energy consumption of 895,162 kw.-hr. for the period, or 149 kw.-hr. per seat-year, according to a recent analysis by the central station supplying the service. The contents of the theater total 2,765,000 cu.ft., making the average annual consumption of energy per cubic foot 162 watt-hours per year.

The equipment consists of two 140-hp. Wittenmeier compressors providing about 220 tons of refrigeration, an 80,000-cu.ft.-per-minute Clarage washer, a 75-hp., 180,000-cu.ft.-per-minute Sturtevant double-inlet blower fan and a 75-hp. chilled water pump. The air washer and fan are located in a separate room on the roof, the compressors being in the basement. Heating coils are provided for winter use and the system is thermostatically controlled. The system is used every day in the year. On weekdays it operates from 9:20 a.m. to 11:20 p.m.; Sundays and one holiday it is open from 12:20 p.m. to 11 p.m. Outside air is drawn into the washer by the fan, where it is sprayed, cooled and the humidity reduced. The conditioned air is then mixed with the return air and carried by ducts to grills in the wall at the top of the theater and over the balconies. The air is returned through openings under the seats. In winter the outside air is preheated, humidified by the washer and passed over heating coils before distribution. Operating data are given in the accompanying table.

Two Years' Operations of Air Conditioning System in New England Theater Seating 3,000

Approximate refrigeration tonnage	220
Maximum demand, refrigeration equipment, est. kw	280
Maximum demand, water pump, est. kw	75
Maximum demand, fan, est. kw	75
Maximum demand of system, total kw	430

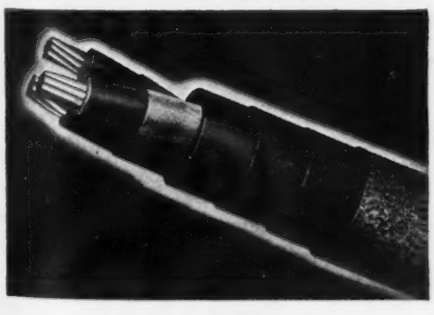
Energy Consumption	1934 Period —Kilowatt-	1935 Period Hours—
Compressor No. 1	81,498	61,619
Compressor No. 2	80,292	60,707
Total, two 140 hp. motors	161,790	122,326
Water pump, 75 hp	60,410	45,674
Fan, 75 hp	227,481	277,481
Total system usage	449,681	445,481
Period for cooling and dehumidifying, days	102	91
Hours of operation cooling and dehumidifying, hours	1,415	1,071
Period of operation, entire system, days	365	365
Hours of operation, entire system, hours	4,933	4,933
Condensing water consumed, million cu.ft	1.082	0.817
Maximum condensing water temperature, deg. F	76.5	
Average condensing water temperature, June-Sept. inclusive, deg F	70.9	
Temperature of auditorium: Winter, deg. F	72	
Summer, deg. F	72 to 77	



Better molds and increased production follow use of electrically heated foundry patterns

TO "SHOW OFF" *Mother Nature*

BEFORE THOUSANDS OF TEXANS



THE City of Fort Worth installed an extensive flood lighting system to "show off" its beautiful Botanical Gardens at night. American Steel & Wire Company Non-Metallic Triple "L" Trench Cables were selected to supply current for these lights.

These Trench Cables are available in single, twin and multiple conductor constructions and in all sizes for any voltage. The insulation is our Amerite rubber which has low water absorption, perfect aging characteristics, and is in daily operation at voltages up to 13 K. V. Fibrous fillers are eliminated and replaced by an integral sheath and fillers of acid, alkali and water resisting compounds.

AMERICAN STEEL & WIRE COMPANY
208 S. La Salle Street, Chicago
Empire State Bldg., New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors.* United States Steel Products Company, New York, *Export Distributors*

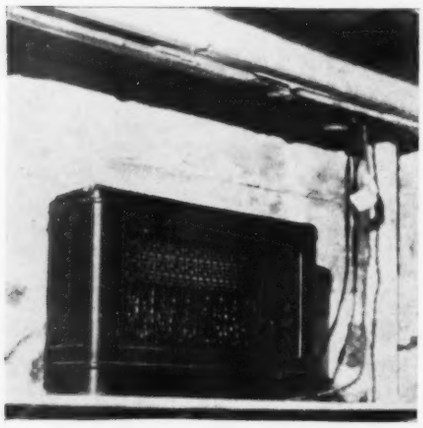
UNITED STATES STEEL

Electric Heater Cuts Coal Cost in Office

By W. B. CONANT
President Conant Machine & Steel Company, West Concord, Mass.

To heat our shop office without overwarming our fabrication department by forcing the steam system above the point of economical use we installed a 5-kw., 220-volt "Hot-point" electric air heater in a basement store room immediately under the floor. The office is at one end of our building and is 7 ft. 8 in. high, with a main section 9x12 ft. and an ell 4x12 ft. in dimensions. The electric heater is located under a 10x12-in. register, through which it discharges air into the office, the cool air being exhausted into the basement compartment through a 9x12-in. register about 7 ft. distant. This gives a very satisfactory circulation without the use of ducts.

The office is provided with a steam radiator which is used in cold weather for the major heating requirements. In the fall and spring, before it is necessary to start the steam system, electric heat suffices for the office, and in winter electrical energy supplements the coal-fired system with economy. We operate the heater on the off-peak rate of the Concord municipal lighting department, which is 1.4 cents per kilowatt-hour, the peak period being between 4:30 p.m. and 7 p.m. from October 1 to March 1. A time clock cuts the heater off the peak in case the control switch is closed, and during the day we operate the heater manually according to the weather and steam service, maintaining 70 deg. in the office. In cold weather the time switch is set to close the heater circuit at 7 a.m., which raises the office temperature to a satisfactory point at the opening hour of 8. The heater is wired through two Palmer safety switches for half or full rated output, as desired, one set of coils being controlled by each switch.



Electric radiator cuts supplementary coal cost in half

Heater was installed September 18, 1935, and our monthly energy consumptions and bills have been as follows: October 8 (partial month), 311 kw.-hr., $4.35; November 8, 510 kw.-hr., $7.14; December 7, 530 kw.-hr., $7.42, and January 7, 530 kw.-hr., $7.42. Besides the saving in labor which would be required for using fuel-fired service in parts of the fall and spring, when the shop proper needs no heat, we estimate that if we relied on steam heat alone for the office, the operating cost for added coal would be about double what we pay for electric heat on this off-peak basis.

•

Pump Plus Gas Lift Controls Oil Output

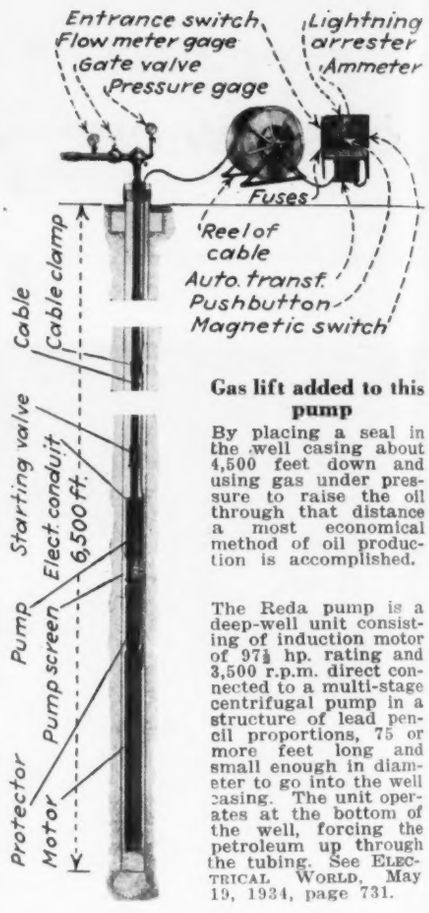
By W. H. STUEVE
Oklahoma Gas & Electric Company, Oklahoma City*

In the Oklahoma City oil field up to about July 1, 1935, the Oklahoma Gas & Electric Company had made approximately thirty connections to Reda pumps for the Phillips Petroleum Company, of which connections only five or six were used for any considerable length of time. In the summer of 1935 the Phillips Company discovered that the Reda pumps normally rated at 97½ hp., lifting from a depth of 6,500 ft., and producing 1,200 bbl. per day, could be made to produce approximately 4,000 bbl. by pumping from the bottom of the hole to within 4,500 ft. of the surface, at which point a hook wall solid packer was installed, making the upper portion of the casing a completely sealed chamber into which gas could be injected under high pressures of about 500 lb. and the 4,000 bbl. started by the Reda pumping unit could be raised to the surface very economically with gas lifting.

Beam pumps operating at twenty 48-in. strokes per minute in a 1¼-in. working barrel could produce only about 200 bbl. of fluid per day. Gas-lifting methods could produce 1,000 to 3,000 bbl. per day, but the gas-oil ratio averaged 5,000 cu.ft. of gas per barrel, making such lifting cost approximately 40 to 50 cents per barrel. Under production control regulations the wells were allowed to make 1,600 to 1,800 bbl. of oil per day, about 40 per cent of their controlled capacity. The beam pump could not reach this production and therefore was out of consideration, even though its cost was only 2 cents per barrel of oil raised. The gas-lift method was expensive. The Reda pump and gas-lift combination, costing about 5 cents per barrel, was the answer, and now there are more than 100 wells so equipped that produce at potential capacity for twelve to fifteen days per month and are shut down when the allowable production for the month has been reached.

It is my estimate that next year we should have approximately 150 active Reda pumping units in service, representing a total connected load of 15,000 hp. Demand charts recently removed from an oil field substation in Oklahoma City serving these units exclusively indicates that the diversity of use is about 2½ to one. In other words, the demand on the system from 25 Reda pumping units averages approximately 1,000 kw. during a given month.

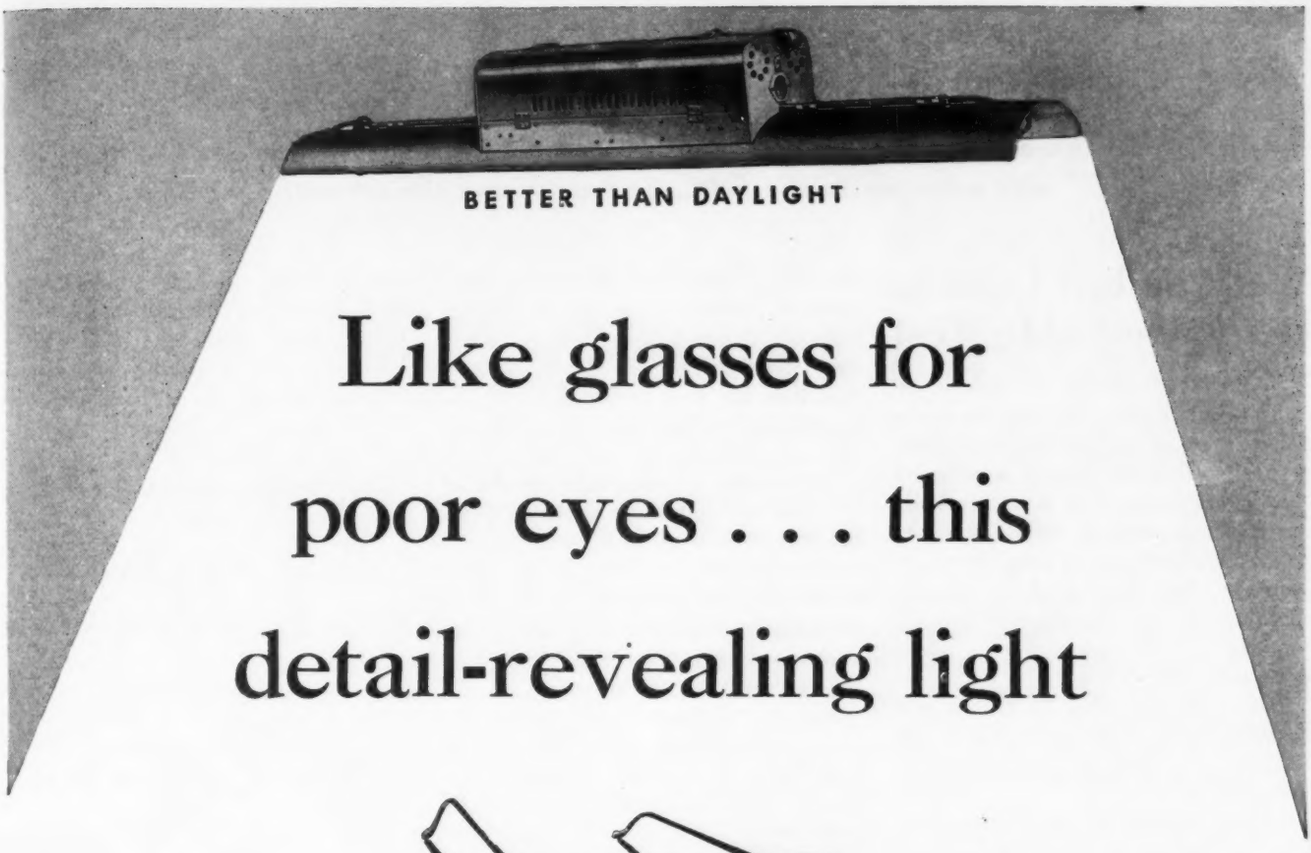
*From paper to Petroleum Electric Power Club.



Gas lift added to this pump

By placing a seal in the well casing about 4,500 feet down and using gas under pressure to raise the oil through that distance a most economical method of oil production is accomplished.

The Reda pump is a deep-well unit consisting of induction motor of 97½ hp. rating and 3,500 r.p.m. direct connected to a multi-stage centrifugal pump in a structure of lead pencil proportions, 75 or more feet long and small enough in diameter to go into the well casing. The unit operates at the bottom of the well, forcing the petroleum up through the tubing. See ELECTRICAL WORLD, May 19, 1934, page 731.



Like glasses for poor eyes . . . this detail-revealing light

Truly efficient plant operation demands light — not for average eyes, but for the poorest eyes it is willing to employ. Cooper-Hewitt Mercury Vapor Light reveals details and quickens visual response to such a great extent that it is "like glasses for poor eyes."

Skilled workers speed through entire shifts without eye-strain fatigue. They turn out products uniform in quality, and management finds Cooper-Hewitt Light materially cuts down rejects — a direct profit.

Save the energy your workers ordinarily waste in the mere physical act of "seeing." Give them the assistance of Cooper-Hewitt Mercury Vapor Light. You will banish harsh contrasts between light and shadow . . . eliminate glare . . . reduce accidents . . . and minimize labor turnover. Get full details on this detail-revealing, restful Cooper-Hewitt Light. Address the General Electric Vapor Lamp Company, 805 Adams Street, Hoboken, New Jersey.

GENERAL ELECTRIC VAPOR LAMP COMPANY

680

COOPER-HEWITT MERCURY VAPOR LIGHT

NEW ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Wet Conduit Used in Defective Cable Test

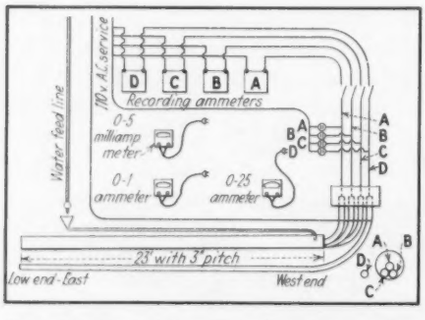
In order adequately to answer inquiries from utility engineers as to the behavior to be expected from secondary network cable having a defective sheath and lying in a wet duct while energized at normal operating voltages, the Rockbestos Products Corporation has developed a test to supplement its "Springfield test,"* showing service performance under wet conduit conditions.

A 4-in. fiber conduit 24 ft. long was installed 12 in. underground in a cinder fill. Three No. 4/0 lead-sheathed network cables were bound rigidly together to preserve their relation and they were pulled into the conduit so that they lay in a pyramid form. As shown in the accompanying illustration, an arrangement was made to feed a little stream of water into one end of the duct and out at the other at a rate of three gallons in 24 hours.

The cable on top had a 10-in. slit in its sheath near the center of the length so that the insulation was free to absorb dampness from the air. Since the cable was on the top of the group of three it did not lie directly in the water. One of the two bottom cables had three $\frac{1}{16}$-in. holes drilled in the sheath near the center of the length and spaced 120 deg. apart around the cable so that one hole was continuously submerged. The other cable had five $\frac{1}{16}$-in. holes drilled in the sheath 5 ft. apart and on a long 120 deg. spiral so that at least two holes were on the bottom and continuously submerged. Another No. 4/0 cable was laid directly in the sand alongside the conduit. It had a $\frac{1}{8}$-in. ring of lead removed from its sheath at the center of the length. The sand was damp according to the weather.

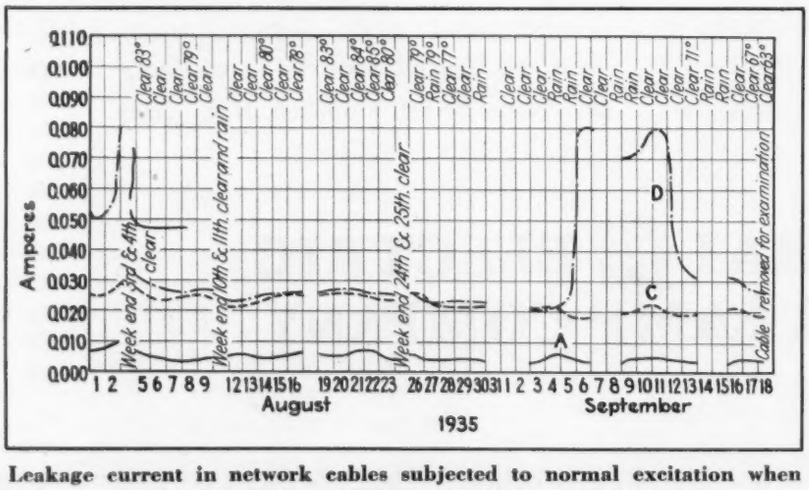
All four cables were constantly energized at 110 volts a.c. and leakage currents were measured twice a day for six months when the test was interrupted for examination. No change had taken place in the external condition of the lead sheaths of any of the four cables. Since the test is being continued indefinitely the cable sheaths were not opened up. The accompanying chart gives the leakage current for each of the cables during the last two of the first six months of the test.

*Described in ELECTRICAL WORLD, April 1, 1933, page 406.



Arrangement of apparatus for underground moisture test of lead sheath network cable

"A" No. 4/0 cable—10-in. slit in cable sheath.
"B" cable—3 $\frac{1}{16}$-in. holes in cable sheath.
"C" cable—$\frac{1}{16}$-in. holes 5 ft. apart in cable sheath.
"D" cable—$\frac{1}{8}$ in. ring of lead removed—laid in sand.



Leakage current in network cables subjected to normal excitation when lying in wet duct and having defective lead sheath

Curve for cable "B" varies between limits of 0.09 and 0.60 amp.

Polarizing Glass Cuts Headlight Glare

Sheets of this glass oriented at 90 deg. in windshield and headlights of automobiles reduce glare by polarization

Interesting because of its possible effect upon future developments in highway lighting is the commercial production of "Polaroid" glass, which, among other things, has been shown greatly to reduce glare from automobile headlights by polarization.

This new glass has the property of absorbing all the light rays that pass through it except those vibrating in a single given plane; these rays are transmitted. A sheet of this glass placed behind each headlight lens of an automobile will so control the light that when the headlights are viewed through a windshield of similar glass, oriented at 90 deg. with respect to the headlight glass, no glare is evident. Actual road tests showed that pedestrians were seen as well as though no car was approaching.

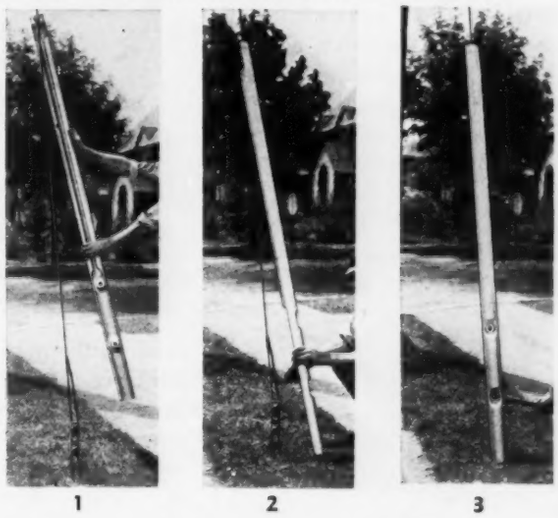
Fundamentally this glass is a sus-

Staz-Rite the UNIVERSAL GUY GUARD

Only one piece to handle . . . no nuts, bolts or parts to lose . . . retainer at top locks guard securely to strand . . . bottom attaches to guy clamp bolt . . . it STAZ-RITE on the job . . . easy to install . . . no special tools required . . . no sharp edges . . . 100% protection . . . economical . . . visible . . . neat . . . furnished half round (left) and full round (right) styles . . . Build right with STAZ-RITE, the outstanding Guy Guard.

A special edition of "Pole Line News" contains full descriptive information. Send for your copy today.

3 Simple Operations Complete the Installation



1 2 3

1. Placing on strand. Welded retainer at top of guard forms a secure attachment. 2. Depressions in guard allow attachment to either head or nut end of guy clamp bolt. 3. Guard securely attached. Lineman's wrench only tool necessary to complete installation.

UTILITIES SERVICE CO.

ALLENTOWN PENNA.

pension of minute artificial crystals in a cellulosic matrix, only a few hundredths of an inch thick. Individual crystals have the same property of the glass they form in that they absorb all visible light in one of its plane polarized components and transmit a large portion of the other component. By orienting all the crystals in the matrix uniformly the optical effect of a large single crystal is produced. The glass is a reported development of Edwin H. Land of the Land Wheelright Laboratories, Boston.

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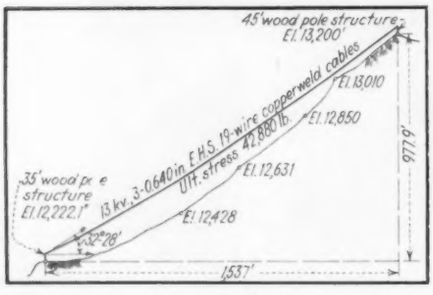
Minimum Sag Span on Steep Rocky Slope

By P. B. HULL
Electric Distributor Engineer
Public Service Company of Colorado, Denver

In building a 13-kv. tie line crossing a spur of the Continental Divide at an elevation of about 13,200 ft. it was necessary to construct a long span of unusual characteristics. The horizontal distance between supports is 1,537 ft. and vertical distance is 978 ft., giving an angle of approximately 33 deg. from the horizontal. The profile of the mountain at the only practicable route available is shown in the accompanying illustration, and while the slope does not look excessive, actually it was almost impossible to descend from the top without the aid of ropes.

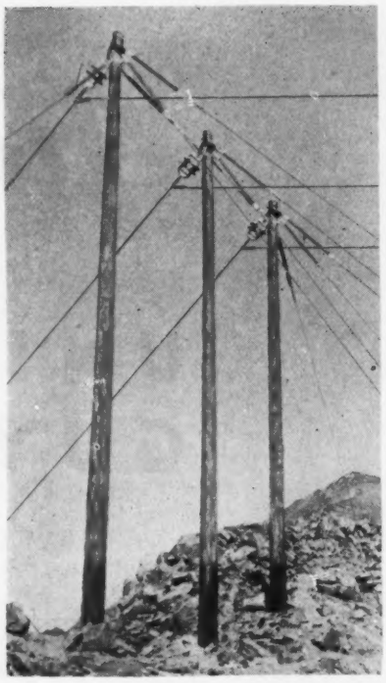
Conductor used in this span was 0.640-in. extra high strength Copperweld, 19-wire cable, having a test breaking load of 42,880 lb. This conductor was chosen as having the minimum of sag, enabling us to clear irregularities or projections on the slope, which otherwise would have required a great amount of expensive and dangerous blasting to remove.



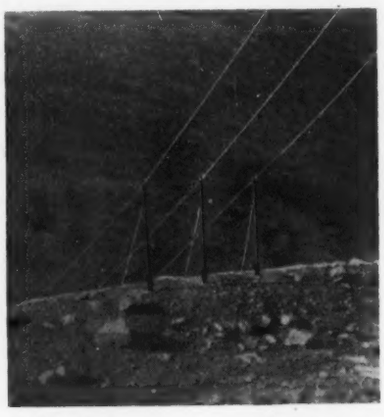
Conductor with minimum sag clears projections on slope without blasting

Three conductors were installed, the stringing tension at 40 deg. F. being 7,840 lb. Each conductor is dead-ended on a separate pole, those in the top structure being 45-ft. poles and those at the bottom being 35-ft. poles. All three poles at each end of the span were tied together and head and side guyed, with wood strain insulators in the guys. Conductor separation is 15 ft. Ohio Brass 50,000-lb. strain clamps and yokes were used, with two strings of two 25,000-lb. insulators each, both strings being in parallel for each dead end. Due to the excessive vertical pressure on the upper structure, pole bands of our own design were used for attachment of the dead-end hardware.

The line is located in a district where very severe storms occur frequently and on this account the span was designed to withstand safely a loading of 1¼ in. radial ice and 10 lb. wind, this loading giving a maximum conductor tension of 26,215 lb.



Take-off for 33-deg. drop of mountain span with Copperweld conductors



Individual supports terminate long, steep mountain span

Air Bomb Shortens Insulation Test

Since the "oxygen bomb" and "Geer oven" tests are rather lengthy, a test known as the "air bomb" has been devised. In a recent paper before the New York Section, A.I.E.E., H. E. Thompson of the Anaconda Wire & Cable Company stated that, on some types of compounds, the test reveals a depreciation in physical properties in five hours equivalent to that obtained in 21 days in the oxygen bomb. The new test uses air as the medium, under a pressure of 80 lb. per square inch at a temperature of 260 deg. F. (127 deg. C.).

The air bomb test is similar to the oxygen bomb test in that physical properties of aged specimens are compared with those of unaged specimens. Advantage lies in the speed and in the fact that a visiting inspector can witness the complete tests in a day or two. Disadvantage lies in interpreting the tests in terms of operating life. Nevertheless, all three types of accelerated aging tests give results that are definite, reproducible and of great significance to the rubber technologist who is working on non-metallic sheathed cables.

Even though there is still no direct correlation between the accelerated aging tests and operating life, these tests do show relative merits of different rubber compounds as well as serving as control tests for the manufacturer.

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High-Intensity Neon Signs

About 40 times the light intensity of normal Neon signs is claimed for the new "Superlux" neon tube which is being put on the market by "Ophineon" (Osram-Phillips Neon, Inc.) of Prague, Czechoslovakia. The first signs of this type are shortly to be installed in Prague. According to the manufacturers, the tube operates with a hot cathode and has a light output of 21 lumens per watt. These tubes are stated to be similar to those turned out by the same company for air-field illumination, which have a light intensity of 1,000 cp. per running meter.—"Electrical Foreign Trade Notes," Department of Commerce.

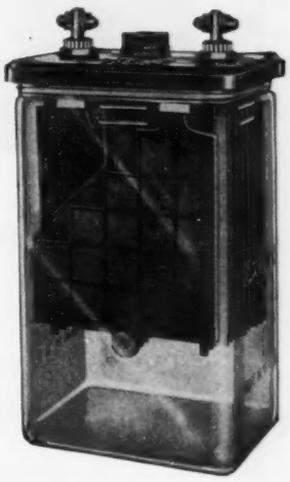
Our Public Servants In Time of Trouble

Only those who have lived through the experience of a flood know what that word means. They know how the mad, swirling waters of a swiftly rising river can so completely isolate the most modern of cities and cripple electric light and telephone services.

Too much praise cannot be given to utility employees in the flood areas. Time and time again they demonstrated their devotion to public service.

Exide operating engineers were hurried into the stricken communities to assist the users of Exide Batteries. They saw hundreds of utility employees, both men and women, who had stuck to their posts under almost unbelievable conditions. Day and night, they had toiled heroically to maintain communication with the outside world, and restore electric service wherever possible. Bleary eyed and haggard these workers plainly showed the terrific strain under which they had labored, and the lack of several days' sleep.

It is interesting to know that in numerous instances Exide Batteries continued to deliver power, even though completely submerged; and when the waters receded they could be kept in service by merely recharging.



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THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE
Exide Batteries of Canada, Limited, Toronto

Are You

"KIDNAPPED KURRENT KONSCIOUS"?

One polyphase current "snatch" case may exceed in lost revenue, a flock of single phase cases.

You know that Superior single phase meter enclosures DO DISCOURAGE diversion and have proven their worth.

Superior Polyphase meter enclosures will do it too. Sure we'll send Bulletin 344.

Our Business is to help you get paid for ALL energy consumed.

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*Been at it Since 1920

SUPERIOR
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Public Utilities and the National Need

[*Continued from page 34*]

sustained a far more rigorous government regulation in the form of direct competition. *The Supreme Court has in effect precluded direct regulation as a governmental policy, but has left ajar the door to socialism. I do not favor extensive government ownership and I am sure the great majority of the American people will not favor or demand it unless they are forced to do so as a last resort.*

The average bill for 25 kw.-hr., residential service, in the state of Idaho, is $1.93. Seventy-five per cent of Idaho's farms do not have radios, 70 per cent do not have electricity, 60 per cent do not have telephones. With the almost unlimited potential hydro-electric resources in the state, there is no sound economic reason why this should be so, and in the course of time those who are not now receiving these services will receive them, if necessary, through government ownership. *Fulfilling the public need in the course charted by the T.V.A. is the place for the privately owned utility. If it will take advantage of that place government ownership will not become generally necessary.* Wherever experiments have been tried it has been shown that a continuing program of rate reduction on the part of utilities has increased consumption to such an extent that the profits of the utility have increased, public needs have been met and general business of the area affected has been stimulated.

Some governmental interference was necessary to place this fact squarely before the public utilities. The government can, however, with a comparatively small number of governmentally conducted power projects throughout the nation to serve as experiment stations or "demonstration utilities," assist in placing utilities on such a basis as to render successful, satisfactory and admirable service from every viewpoint. Whether they know it or not, the owners and operators of public utilities occupy a position of trust and responsibility unlike that of any other industry. They can, under present conditions—and I believe they will—realize their trust, assume their full responsibility and contribute their share toward the more abundant life. In doing so they will help themselves, assist their government and serve the American people.

Utility Common Stock Changes

[*Continued from page 35*]

the corresponding date. Respectively, these three classifications had lost 7.49, 10.95 and 16.48 percentage points during March of 1935. Only communications common stocks, which had advanced to 10.16 per cent above March 1, 1933, registered a gain in average market price during the month.

Utility stocks in rise

As at September 1, 1935, or six days after the President had approved the Public Utility Act, sharp advances had occurred in the average prices in all of the enumerated classifications. All utility common stocks had advanced in price to 22.74 per cent above the March 1, 1933, level, while the price of all United States common stocks had increased 104.77 per cent over the March, 1933, figure. Respectively, these represented gains of 39.67 and 43.78 percentage points over the average prices of six months earlier. Of the utility stocks, gas and electric operating common stocks were still 11.25 per cent below the March 1, 1933, average price, while the gas and electric holding company, communications and miscellaneous utility common stocks were 12.70, 44.47 and 153.18 per cent, respectively, higher than their March 1, 1933, averages. In the six months intervening between March 1 and September 1 of 1935 gas and electric operating commons had increased 35.43 percentage points, gas and electric holding company commons had advanced 57.14 points, communications commons 34.31 points and miscellaneous utility commons 72.39 points.

By January 1, 1936, all of the six classes of common stocks had moved above the March 1, 1933, average prices. All utility common stocks were 44.57 per cent higher than 34 months earlier, while the common stocks of all United States corporations were 141.46 per cent above the corresponding figure. Respectively, these average prices represented improvements of 21.83 and 36.69 percentage points in the last four months of 1935. Of the utility common stocks gas and electric operatings were 3.22 per cent, gas and electric holdings were 38.74 per cent, communications were 68.40 and miscellaneous utilities were 164.72 per cent above the March 1, 1933, average prices. These averages represented gains of 14.47, 26.04, 23.93 and 11.54 percentage points, respectively, in the last four months of the year.

From the trends established by the average prices for the various classes of utility common stocks and for all utility commons, it would appear that the investing public has decided that the utilities of this country, both of operating and of holding character, will be permitted to continue their activities without too much federal interference and that their equities are becoming more attractive for the employment of surplus funds. However, when all utility common stocks are but 44.57 per cent higher than the average prices of March 1, 1933, while the common stocks of all United States corporations have registered gains of 141.46 per cent in the same period, distinct pressure against the industry is evident. Especially is this true when the common stocks of even operating gas and electric companies, against which the Public Utility Act of 1935 was supposedly not directed, are but 3.22 per cent above their average quoted values as at March 1, 1933.

Secondary Network Goes Overhead

[*Continued from page 38*]

already in service on the old system, as they are always dry. The usual aerial installations consist of either three 50- or 75-kva. standard distribution transformers rated at 2,400/120 volts and connected star on both sides with neutrals tied together and grounded.

In lieu of the customary three-position primary line disconnecting and grounding switch on network transformers, box type primary cutouts are used, equipped with copper links, and are intended for disconnecting purposes only. In this way transformer capacity required to burn secondary faults clear is not lost by blown primary fuses.

Transformer banks are spaced about two per block in the heavy load areas and one per block in lighter loaded sections. With two primary circuits available, the transformer banks are connected alternately to the two circuits, so that with one primary out of service there will still be at least one transformer bank energized in blocks heavily loaded and on every other block in the lighter loaded area.

The PEMCO

Cable Layer

A simple, rugged cable laying plow that saves expensive trenching and back-filling — eliminates costly pole line construction. The answer to rural electrification and parkway problems.

Lays single cable up to 1¼". Two cables up to 1" dia. To depth of 16" to 20". Drawn by truck winch, portable winch or tractor. Small crew. Completes job as it goes. Saves time — money.

For example, on one job alone a utility company saved $15,000. Many companies have slashed costs on rural line construction. Send for prices and complete information.

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BUILDING UP THE LOAD

New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers

"Office of Future" for Selling Light

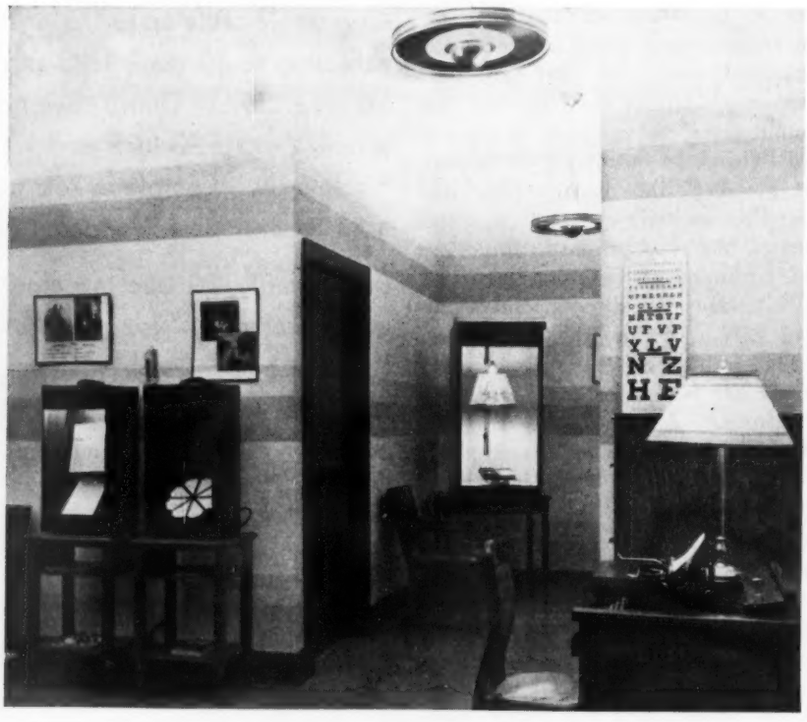
An ingenious idea for selling light in offices, combined with application of the same idea to the use and merchandising of office space, blossomed out in the Marquette Building in Chicago recently. It is an "Office of the Future" based on the theory that office space should no longer be considered as a mere housing facility for business, but rather should be so equipped —in decoration and lighting—that it gives the tenant a definite efficiency item which is reflected in increased personnel efficiency.

The demonstration comprises (1) the "Office of the Future"; (2) an office of exactly the same floor area, but lighted, furnished and decorated in ordinary fashion for contrast, and (3) a room in which scientific measuring instruments enable visitors to prove to themselves the greater ease and efficiency with which work can be performed in the new as against the old style office.

In the "Office of the Future" lighting equipment which provides more than 20 ft.-candles of illumination per square foot has been installed. Indirect ceiling fixtures are used which produce the highest quality of illumination evenly distributed over the entire office space without shadow or glare.

The additional cost of such illumination is only a very minor percentage of the savings which are effected. Ordinary lighting, having an intensity of less than 5 ft.-candles, costs on the average about 10 cents per square foot per year. High-intensity illumination in the "Office of the Future" costs about 25 cents per square foot per year, an increase of 15 cents.

But this 15-cent increase is only 1 per cent of the average payroll cost and consequently will be absorbed ten times with an increase of 10 per cent in personnel efficiency. Careful and exhaustive tests by engineers have shown that such an increase in personnel efficiency is easily obtainable with proper illumination.



Proving value of lighting in the "Office of the Future"

Quick Calculations Sell Electric Heat

By H. R. STEVENSON
Detroit Edison Company,
Detroit, Mich.

Many jobs will involve the heating up of something on which no information as to the specific heat is readily available. In such cases just remember that the specific heat of water is 1, and for all practical purposes that of everything else is below 1 and in 90 per cent of the cases below ½. It is well to remember melting points of a few common materials, and don't forget that some liquids and solids require heat when changing from solid to liquid state, or liquid to vapor state, called the heat of fusion and the heat of vaporization. Neglecting to remember these latter has caused more than embarrassment in some cases.

The amount of heat required by a job depends to a large extent on the amount of time that can be taken in raising it to the required temperature. Some jobs have automatic temperature control by balancing radiation losses against heat input without the use of a thermostat. On some installations it is cheaper to keep them up to temperature 24 hours a day than to raise them up to working temperature from cold every day. It is also wise in cases where thermostatic control is to be used to install 1½ to two times the amount of heat estimated as necessary if the added installation expense is not too great, and in this manner provision is made for a greater load on the equipment at no extra cost of operation at normal loading, since the thermostat allows the heating units to furnish just what heat is needed.

•

Free Energy Creates 13% Increase

Customers of the Hartford Electric Light Company used an aggregate of 6,190,735 kw.-hr. of "free service" in the twelve months ended December 1, 1935, the value of this energy at the rates which would normally have been

Introducing

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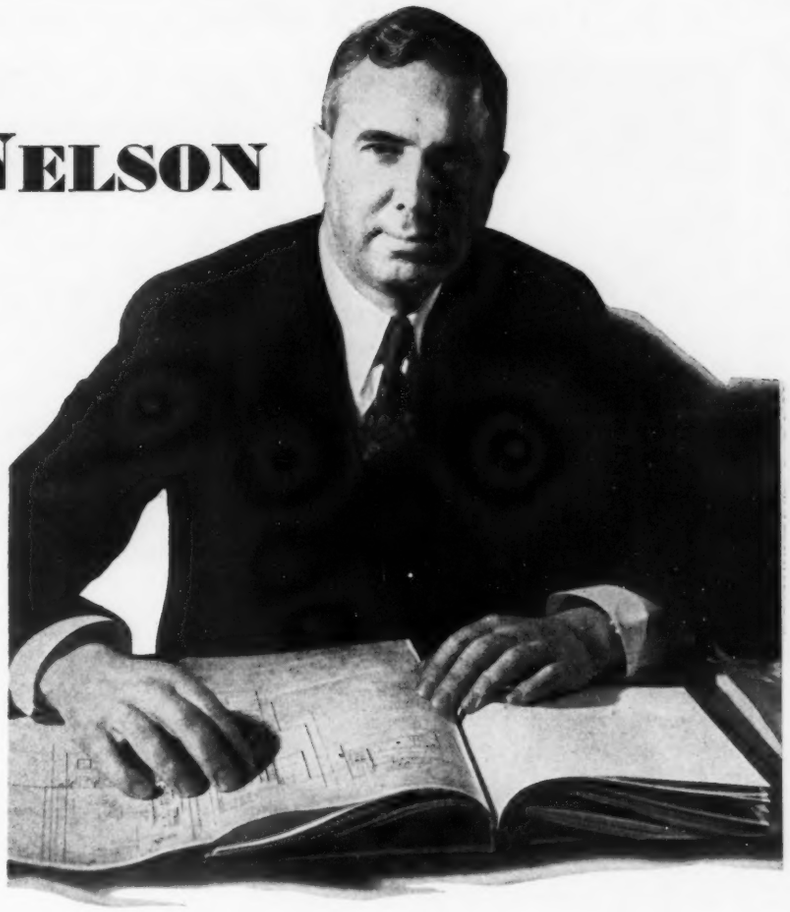
Of

Arthur L. Nelson Engineers,
Boston, Mass.



ARTHUR L. NELSON has been in private practice as a consulting engineer for 15 years, and his work embraces a wide range of electrical, mechanical, and economic problems vital to public utilities, industries, and other clients. Construction, operation, and maintenance developments diversify his interests. Here, for instance, is a typical day's work of this busy professional man:

Examined mail relating to active power projects in six states in the area between New England and Gulf of Mexico; disposed of letters from clients, field engineers of the firm, boiler, turbine and equipment manufacturers. . . . Received large package from the Owens Illinois Glass Co. containing latest specimens of glass wool for thermal insulation of boilers and piping.

Telephoned R. A. Smith, chief engineer Holyoke Water Power Company, regarding capacity of service oil tanks, specifications for 900-lb. valves, and approval of safety valve settings and other details of new steam plant. . . . Conferred with M. H. Kuhner, chief mechanical engineer, Boiler Division Riley Stoker Corporation, on superheater outlet for Holyoke boiler.

Telephoned Vice-President and General Manager Lufkin of Owens Illinois Glass, Newark, Ohio, re: high-pressure steam plant operation. . . . Dictated letters. . . . Played squash at Union Boat Club with Dr. Leland McKittrick. . . . Lunched at Engineers Club, greeted former Chief Engineer I. E. Moultrop of Boston Edison and chatted with friends and acquaintances.

Conferred with Chester F. Buckley, manager Taunton electric light plant, on condenser auxiliary test. . . . Talked with manufacturers' representatives re: automatic combustion control. . . . Dined at University Club; 'phoned to Houston, Tex., about high-pressure steam plant, Imperial Sugar Company, and took 7:25 train home.

Twenty Years an Electrical World Reader

Throughout Mr. Nelson's professional career, Electrical World has been a reading companion by train and in office, aiding him to keep abreast of progress and broadening his interest in electrical development.

Through its editorial vitality and leadership, Electrical World has become the constant "companion" of thousands of engineers and executives throughout the electrical industry. This represents a tremendous market that can be profitably cultivated through Electrical World. For more complete details, address ELECTRICAL WORLD, 330 WEST 42nd ST., NEW YORK, N. Y.

Stage "Props" Aid Kitchen Presentation

To sell the electric kitchen idea to more of its rural customers the Mountain States Power Company, Albany, Ore., prepared this traveling exhibit, which was carried by truck through the territory. An inexpensive set of stage scenery, built up to display the kitchen layout to the best advantage, proved to be a good investment in aiding the audience to visualize kitchen convenience. The scenery was easily packed and added a realistic touch to the demonstrations, which could not be obtained on a bare stage, which usually is all that is available in small towns and rural centers.

charged being $187,525. This so-called "Share-the-Benefits-Plan" gave 50 kw.-hr. of free energy for every 10 additional kilowatt-hours consumed per month and was influential in raising the average consumption per residential customer per annum from 858 kw.-hr. in 1934 to 973 in 1935. The average price per kilowatt-hour consumed per domestic customer was 4.1 cents in 1935, and the average value of the energy consumed on the free basis in the year just past was 3.03 cents.

President V. E. Bird states that the company expects to reach an average consumption of 1,200 kw.-hr. per domestic consumer before 1938, and at this point the so-called "Electric Home Rate" will become available to all such customers regardless of their individual usage. This rate provides for an initial small block of power at a higher rate to take care of minimum lighting and the miscellaneous small usage, with three succeeding blocks of 2½, 2 and 1½ cents for cooking and other major appliance service. Meanwhile an intermediate rate giving about one-third the reduction of the electric home rate is applicable for customers not earning the lower tariff. For the past three years the company has declared no "customer dividend" in the form of an October bill discount, net earnings having been insufficient, but $38,000 has been appropriated from the 1935 earnings to be distributed to the various communities served for use in caring for the bills for essential utility services of persons on their relief rolls.

•

Cost of Appliances for Rural Customers

Study of the investment in machinery and wiring that would be required to develop various annual farm loads was made in connection with a "Survey of Rural Electrification" in Massachusetts, undertaken by the F.E.R.A. of that state. Results of the study* are given in the accompanying table.

This tabulation gives for each use-group the type and cost of appliances which it would be necessary for the farmer to purchase in order to come in the use-block indicated. An estimate of the cost of wiring to serve these appliances is also given. Total customer investments necessary, including wiring and appliance costs, vary from $130 for the 400-kw.-hr. group to $1,779 for the group using 3,000 kw.-hr. per year.

Since in nearly all cases the first cost of appliances when considered with the economies resulting from their use will determine the decision to invest, it is reasonable to expect that because of the farmer's lower range of cash income only moderate purchases of appliances will result, for the initial years of service at least.

*Choice of appliances for various use groups in this study are based on survey of farm customers' needs as given by chart on page 93, ELECTRICAL WORLD, March 14, 1936.

Cost of Appliances and Wiring for Rural Customer Use-Groups

Rural user's outlay steadily outstrips his increase in consumption of kilowatt-hours as major appliances are successively added.

Customer class, kw.-hr. per year	400	600	800	1,000	1,200	1,500	2,000	3,000
Home lighting install. and fixtures	$100	100	110	110	160	160	160	160
Iron	5	5	5	5	5	5	5	5
Radio	25	25	25	25	25	25	25	25
Toaster	...	3	3	3	3	3	3	3
Percolator	...	6	6	6	6	6	6	6
Vacuum cleaner	...	40	40	40	40	40	40	40
Clock	...	4	4	4	4	4	4	4
Curling iron	...	...	2	2	2	2	2	2
Radiant heater	...	...	4	4	4	4	4	4
Pumping outfit, home	...	...	70	70	70	70	70	70
Washing machine	...	...	...	50	50	50	50	50
Wiring for bar light (1 or 2 bldgs.)	...	...	...	35	35	70	70	70
Wiring for poultry (1 or 2 bldgs.)	...	...	...	...	35	70	70	70
Pumping outfit, farm	...	...	...	...	...	150	150	150
Refrigerator, home	...	...	...	...	...	$130	130	130
Yard lighting (wiring)	...	...	...	...	...	25	25	25
Service motor	...	...	...	...	...	100	100	100
Range	...	...	...	...	...	...	120	120
Refrigerator, dairy	...	...	...	...	...	...	150	150
Cream separator	...	...	...	...	...	...	40	40
Bottle washer	...	...	...	...	...	...	25	25
Feed grinder	...	...	...	...	...	...	150	150
Milking machine	...	...	...	...	...	...	...	250
Milk house light (wiring)	...	...	...	...	...	...	...	35
Dairy water heater	...	...	...	...	...	...	...	25
Ironing machine	...	...	...	...	...	...	70	70
Hot plate	...	...	...	...	4	4	...	...
Total	$130	183	299	384	443	918	1,469	1,779
Wiring (cost)	$100	100	140	175	230	325	325	360
Appliances (cost)	$30	83	159	209	213	593	1,144	1,419
Kw.hr. per dollars invested	3.08	3.28	2.68	2.60	2.71	1.63	1.36	1.69

"There's a slack puller for use on overhead lines," a buyer said,

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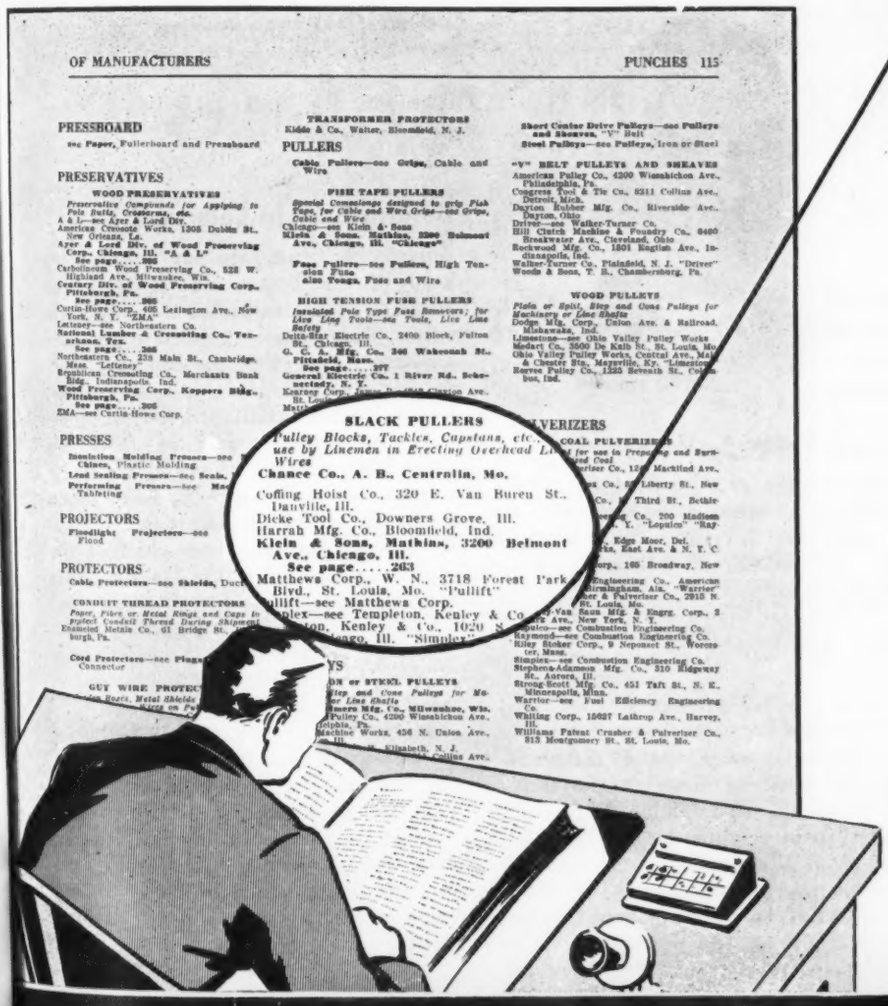

Simple reference to the heading, "Slack Pullers" under "P" in the directory section of Electrical World's Buyers Reference Number revealed a complete list of manufacturers immediately.

You will find many short-cuts to make your buying of electrical and allied products easier with this handy reference volume.

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MEN OF THE INDUSTRY

A. O. Anderson Assigned New Duties in New York

Announcement has been made by G. J. Chapman, manager of the specialty appliance sales division of General Electric Company's appliance and merchandise department, to the effect that J. M. Walker has resigned as the division's New York district manager to accept the position of general sales manager of Rex Cole, Inc., New York distributor for General Electric refrigerators and other home electric appliances. A. O. Anderson, who has been engaged in department store sales activities for the division, succeeds Mr. Walker as New York district manager. At the same time it was announced that Lawrence Jennings has been appointed Eastern manager for the central-station sales activities.

•

▶ W. T. NEILL, for many years supervisor of rate and regulatory matters for the Pacific Power & Light Company, Portland, Ore., was elected vice-president of that company at the regular monthly meeting of the board of directors on April 9.

▶ R. B. ROBERTS, JR., formerly division sales manager for the Florida Power & Light Company at Bradenton, has been appointed general sales manager to succeed Robert H. Fite, Jr., who has become sales sponsor for Ebasco Services, Inc., New York.

▶ J. B. WHITEHEAD, dean of the school of engineering, Johns Hopkins University, Baltimore, Md., and a past-president of the American Institute of Electrical Engineers, has been appointed by the institute's board of directors to serve for 1936 as an A.I.E.E. representative on the Council of the American Association for the Advancement of Science.

▶ JOSEPH F. PORTER, JR., vice-president and general manager of the Iowa City Power & Light Company, will become vice-president in charge of sales of the Kansas City (Mo.) Power & Light Company on May 1.

▶ H. M. MARSDEN, formerly district engineer Hartford Steam Boiler Inspection & Insurance Company, New York, N. Y., has been made assistant chief electrical engineer with offices at Hartford, Conn. Mr. Marsden was employed by the General Electric Company, Schenectady, N. Y., in test and laboratory work in 1912. During the period 1916-19 he was assigned to the Bureau of Engineering, U. S. Navy, as assistant inspector of engineering material. In 1919 he established his own electrical contracting business, and in 1922 he became a member of the testing and laboratory staff of the Georgia Railway & Power Company, Atlanta. He became electrical inspector in the Cincinnati, Ohio, office of the Hartford Steam Boiler Inspection & Insurance Company in 1923, and in 1930 he was transferred to the New York headquarters as district engineer.

•

Walter E. Hawkinson

new treasurer of Allis-Chalmers Manufacturing Company, has been with the company for 29 years. Since 1926 he held the position of assistant manager of the tractor division and prior to that had served for fifteen years in the treasurer's department.

•

▶ J. M. KENNEDY, president of the British Institution of Electrical Engineers, was the guest of honor at the annual dinner of the Illuminating Engineering Society held recently in London. "The science of illumination is becoming an exceedingly complex study," declared President Kennedy, "and new problems cover economics and psychology. If the vast field is to be adequately dealt with the heartiest co-operation of illuminating engineers and architects is necessary . . ."

▶ E. A. CRELLIN, assistant to the vice-president of the Pacific Gas & Electric Company, San Francisco, Calif., was recently elected president of the San Francisco Engineers' Club. From 1931 to 1932 Mr. Crellin was chairman of the San Francisco section of the American Institute of Electrical Engineers and a member of the national committee on power generation.

A. A. Cree Heads Vermont Utility

Albert A. Cree, whose appointment as vice-president of the Twin State Gas & Electric Company, Rutland, Vt., was announced in ELECTRICAL WORLD January 18, page 70, has been elected president of that company and of the Central Vermont Public Service Company, succeeding William A. Buttrick of Concord, Mass. He was formerly connected with the Lee, Higginson banking interests at Boston and New York, and later was assistant treasurer of the New England Public Service Company, Augusta, Me. Mr. Buttrick is widely known in the utility field, having been head of the Twin State and Central Vermont companies for many years. He achieved a high reputation for administrative ability in handling small and scattered properties on an economic basis and is a past-president of the former New England division of the N.E.L.A. Earlier in his career he was connected with the Stone & Webster organization.

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Boston Edison Changes

LYNN S. GOODMAN, for some years head of the Boston Edison statistical bureau and a member of the rate committee, has been appointed clerk and assistant treasurer of the company, succeeding FRED G. HAVLIN, retired. Mr. Havlin has been connected with the company in various executive capacities since 1892, and for 38 years was secretary to the late Charles L. Edgar, long president of the organization. JUSTIN W. LESTER, for ten years chief of the accounting division of the Massachusetts Department of Public Utilities and lately superintendent of accounting statistics for the Boston company, has been appointed comptroller of that utility, in charge of all accounting activities.

JOHN M. WHITTIER, formerly head of the industrial development division of the promotion department, and STANLEY W. WILSON, formerly head of the merchandising division of that department, have been appointed assistant superintendents, respectively, of the sales and promotion departments, Boston Edison Company.

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▶ DONALD P. WRIGHT has been appointed manager of the Mazda plant of the General Electric Company at Youngstown, Ohio. Since 1924 Mr. Wright has been assistant manager. A graduate of Purdue University, he entered the research department at Nela Park in 1912. Two years later he went to Youngstown as foreman in the sealex department of the local plant and in 1916 was made supervising foreman. In 1917 he became assistant manager of the plant. Mr.

YARDSTICK

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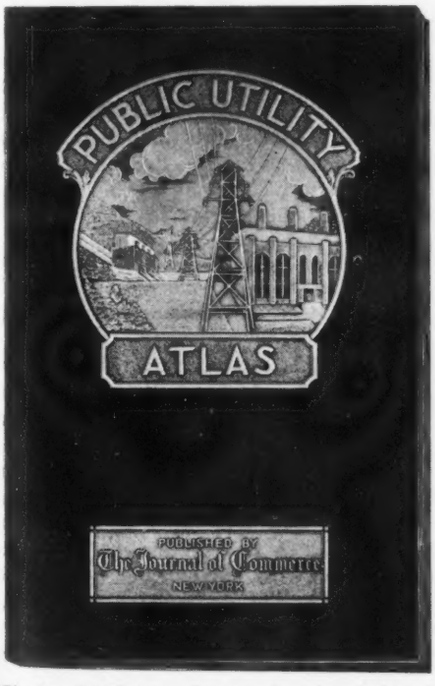

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INTERCONNECTIONS: Special symbol for company interconnections, both within each state and across state boundaries.

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Wright relinquished these duties in 1921 to join the Cleveland Lamp Works, but again resumed his position as assistant manager of the Mazda plant in Youngstown in 1924. His service with the company has been uninterrupted since that time.

▶ FREDERICK A. YOUNG, chief of the Rhode Island division of public utilities, has been designated by Governor Green to represent the state at the third plenary World Power Conference in Washington, D. C., next September.

▶ H. P. CHARLESWORTH, assistant chief engineer of the American Telephone & Telegraph Company, New York, and past-president of the American Institute of Electrical Engineers, has been appointed by the institute board of directors to serve for a year as a member of the board of directors of the American Standards Association.

▶ E. R. NORRIS, who is well known to the machine tool industry, retired April 1 after 44 years continuous service with the Westinghouse Electric & Manufacturing Company in the manufacturing and equipment phase of the business. At the time of his retirement Mr. Norris held the position of assistant to general works manager with headquarters at East Pittsburgh.

▶ E. F. SCATTERGOOD, chief electrical engineer and general manager of the Los Angeles, Calif., Bureau of Power and Light, has returned to his office after an absence of nearly four months due to illness. He underwent an operation last December.

▶ GEORGE L. BERRY, New Deal advocate and mentioned as a possible candidate for Governor of Tennessee, has been named head of a new co-operative electric distribution organization. He is expected to ask the T.V.A. to finance the purchase of lines of three private companies now operating in East Tennessee. The companies are Holston River Electric Company, Grainger County Electric Company and the Hydro Electric Corporation, serving parts of Greene, Hamblen and Hawkins counties.

▶ L. D. SINGLETON, formerly assistant chief electrical engineer Braden Copper Company, New York, is now electrical engineer for the Port of New York Authority. Mr. Singleton was engaged in electrical maintenance and contracting work during 1912-17. He spent the next two years as test engineer of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, and in 1919 he became generating station foreman for the Braden Copper Company, Rancagua, Chile. He held successively the positions of field electrical engineer and senior field electrical engineer before he was transferred to the New York offices as assistant chief electrical engineer of that company. Mr. Singleton is a member of the American Institute of Electrical Engineers.

OBITUARY

L. L. Bailey

L. L. Bailey, for seven years general manager of sales for the Monongahela West Penn Public Service Company, Fairmont, W. Va., died April 15, after a three years' illness. A graduate of Penn State College, Mr. Bailey entered the electric utility field in 1923 as an employee of the Keystone Power Company of Ridgeway, Pa. In 1927 he was transferred to Pittsburgh, where he became an assistant to the president of the West Penn Electric Company. Two years later he entered the Monongahela System of the American Water Works & Electric Company's group of electric properties. Mr. Bailey was widely known in the utility field and served in various capacities with groups interested in promoting the use of the industry's products. He directed a number of campaigns which were highly successful in increasing the consumption of electricity for domestic, as well as commercial purposes in northern West Virginia. Mr. Bailey was 37 years of age.

•

▶ GEORGE LIVERMORE FISKE, for 40 years construction superintendent of the Clark & Mills Electric Company, Boston, Mass., died at Arlington, Mass., April 16 at the age of 60.

▶ DAVID A. LAUGHMAN, field engineer for the Ohio Edison Company for the past 27 years, died, of a heart attack, April 3 at his home in Cleveland. Mr. Laughman was born in Michigan 62 years ago.

▶ EDWARD M. E. HUMPHRIES, street lighting expert, died April 6 at his home in Lynn, Mass. Mr. Humphries was 59 years of age and a native of Philadelphia, Pa. As a young man he became associated with the General Electric Company and served that company for 34 years until the time of his death. He made a special study of street lighting during his association with General Electric.

▶ WILLIS M. RAND, for 39 years a sales engineer for the General Electric Company and its predecessor, the Thomson-Houston Electric Company, and long on the staff of the New England headquarters office at Boston as a specialist in the use of electricity in the shoe, leather and shipbuilding industries, died recently at his home in North Weymouth, Mass. He was born in Waterford, Me., in 1852 and retired from active business in 1925. To a host of friends in the New England territory he was known as "Uncle Bill" and was the repository of a vast amount of pioneer lore.

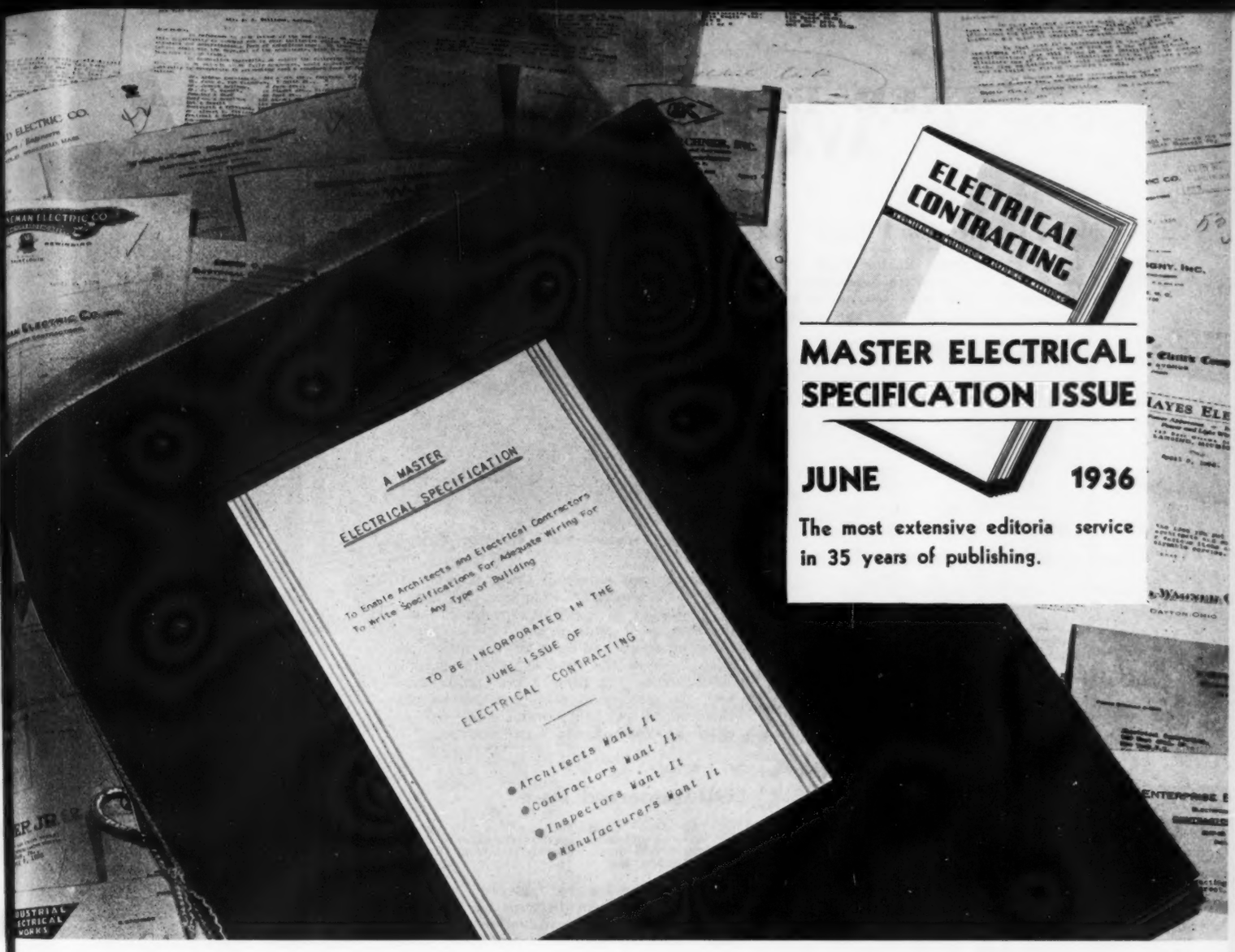
▶ WALTER MOSSGRABER, for the past ten years employment manager of the Simplex Wire & Cable Company, died at his home in Winchester, Mass., April 13, after a three months' illness. He was born in Boston 38 years ago and entered the company's service about twenty years ago.

▶ LESTER D. HATCH, power sales manager of the Westchester Lighting Company, Mount Vernon, N. Y., died April 12 at his home in that city in his sixty-sixth year. Until 1924 Mr. Hatch had been New York manager of the Century Electric Company and prior to that connection he had been New York manager for the Emerson Electric Manufacturing Company, both St. Louis organizations.

▶ HERBERT O. CASTER, prominent utility executive, died April 14 in Polyclinic Hospital, New York, after an illness of several weeks. In 1919 Mr. Caster became associated with Henry L. Doherty as general counsel for the Empire Gas & Fuel Company of Bartlesville, Okla., which position he held until 1925, when he entered the New York office of Henry L. Doherty & Company as a member of the executive committee. Mr. Caster was an officer and director of 46 corporations.

▶ THOMAS SPENCER, associated with the late Thomas A. Edison in his early studies of electricity, died in Indianapolis, Ind., April 16, following a brief illness. He was 80 years old. Mr. Spencer was born in Old Saybrook, Conn. He became installation electrician for the Edison system and at one time was in charge of 28 plants. He moved to Indianapolis in 1918 to become consulting engineer for the Presto-O-Lite Storage Battery Company and held the position until his death.

▶ SIR JOSEPH PETAVEL, well-known British electrical engineer and physicist, died recently in London, aged 62. Sir Joseph had been director of the National Physical Laboratory since 1919. He was born in London and received his early training at London University under Sir John Ambrose Fleming, in co-operation with whom he carried out his first scientific research on the alternating-current arc, the results of which were published in 1896. In 1900 he went to Manchester University as John Harling Research Fellow, and was appointed professor of engineering and director of the Whitworth Laboratories in 1908, retaining that position until called to the National Physical Laboratory in 1919.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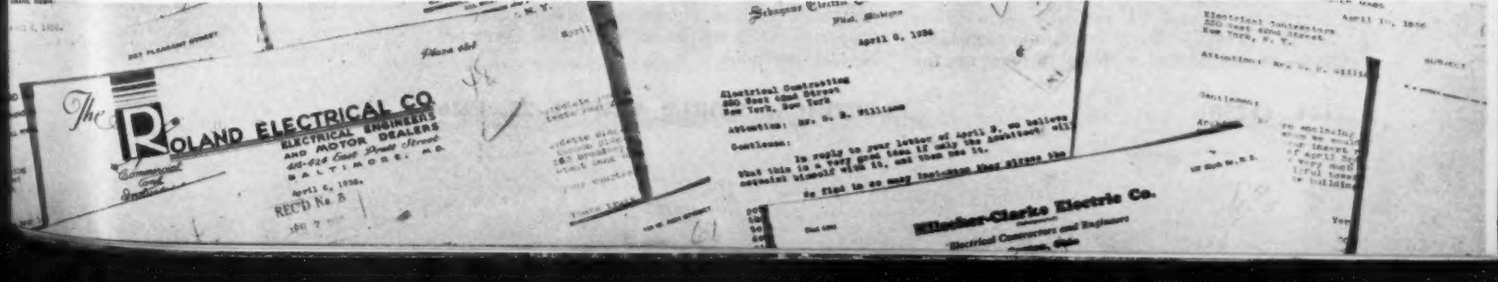
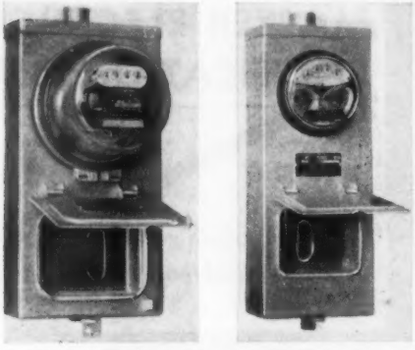


NEW EQUIPMENT AVAILABLE

Meter Connection Boxes

Three combination weatherproof meter boxes and service switches have been marketed recently which were designed to adapt socket-type, glass-cover type and standard



Series 35, 45 and 95 for glass cover, socket and standard meters respectively; each series is available with either 30 or 60-amp. switches. **Walker Electrical Co.**, Atlanta, Ga.

meters to outdoor installations. A special feature claimed for this group is a weather-tight switch opening which is provided with a drainage gutter and a recessed hinged door. Separate sealing permits access for operating the switch or changing fuses, but prevents access to wiring chamber.

•

Rural Hot Line Clamps

Permanent tap connections to rural lines can be quickly made with this new clamp without interrupting service. A special locking arrangement on the clamping bolt as

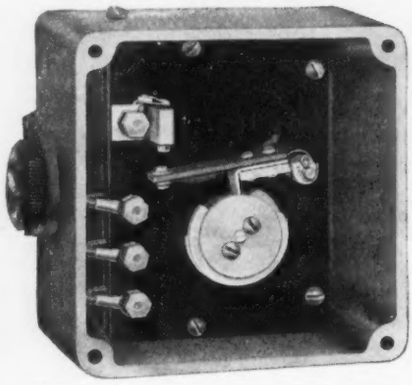
Operated by any switch hook; four sizes to tap main wires from No. 6 to 250-circ.mil copper or No. 8 to 0000 ACSR. **Memco Engineering & Mfg. Co.**, Long Island City, N. Y.

well as on the tap wire bolt insures permanent pressure contacts and prevents the clamp from vibrating loose. Tap wire arrangement provides proper balance and keeps the clamping bolt directed toward the operator.

•

Motor-Operated Timer

This synchronous motor-powered repeating interval timer may be adapted to any time sequence of open and closed circuits over time cycles of seconds, minutes or hours. Two or more rotating adjustable cams, mounted on a drum, driven by the



Walser Automatic Timer Co., New York City

motor through reduction gears, provide the time cycle required. Frequency of contact is a product of speed per revolution and the number of cams on the drum. Varying ratios of closed and open circuits within the fixed limit of the time cycle are obtained by adjusting the cams. This ratio varies with the number of cams and can be provided for 95 per cent on and 5 per cent off or 95 per cent off and 5 per cent on.

•

Oil-Immersed Fuse

"Air Seal" fuses; supplied for 250 and 600-volt operation in standard sizes from 30 to 400 amp. **Rowan Controller Co.**, Baltimore, Md.

A new fuse for use under oil with oil-immersed equipment designed for hazardous and corrosive areas in oil refineries, chemical industries, steel mills and coke plants has been announced. Characteristics are said to be the same as those of standard air-operated fuses.

•

Brush-Holders for Mine Motors

Earlier types of traction motors for mine haulage were equipped with brush-holders having one insulated mounting pin. With constantly increasing loads, motors became overheated, causing loosening of the mount-

Available for types 902, 904 and 909 motors. **Westinghouse Electric & Mfg. Co.**, E. Pittsburgh, Pa.

ing pin. A redesign of brush-holders employing two insulated mounting pins instead of one is said to have overcome the trouble. The new blocks were also designed properly to locate brushes in the correct neutral positions.

Recording Voltmeter

A strip-chart recording voltmeter which retains the refinements of standard switchboard and portable recording instruments and that embodies certain design simplifications is now available. The instrument has a range of 0-150 volts and a single record-roll drive speed of 3 in. per hour. Other simplifications include replacement of the terminal block with standard binding posts on the back, use of a switchboard type resistor cage in place of the back housing and

Type CD-23 and CD-24; dimensions 6x12x11¼ in.; weight, 25 lb. **General Electric Co.**, Schenectady, N. Y.

removal of the hinged window cover. Magnetic damping and metal shielding against stray-field effect are incorporated. Accuracy within 1 per cent of full scale can be maintained with periodic checkings.

•

Planetary Speed Reducers

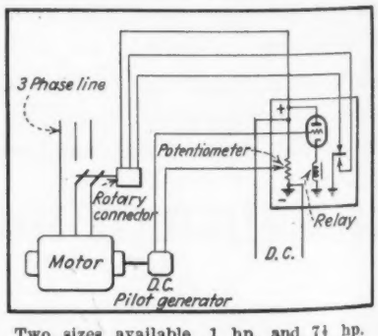
Ratios from 20 to 1 to infinity to 1 are available. **Winfield H. Smith, Inc.**, Springville, N. Y.

Compactness and high efficiency are the outstanding features claimed for these planetary speed reducers. Anti-friction bearings are used throughout. The helical cut, heat-treated alloy-steel gears used are said to insure quiet operation and long life. Units are claimed to be especially desirable where large ratios of reduction are required. Efficiencies as high as 94 per cent are reported.

•

Variable-Speed Control

Infinite speed control from polyphase squirrel-cage induction motors is said to be obtained in the range from 10 per cent full load speed to rated speed by use of an



Two sizes available, 1 hp. and 7½ hp. **Welding Timer Corporation**, Newark, N. J.

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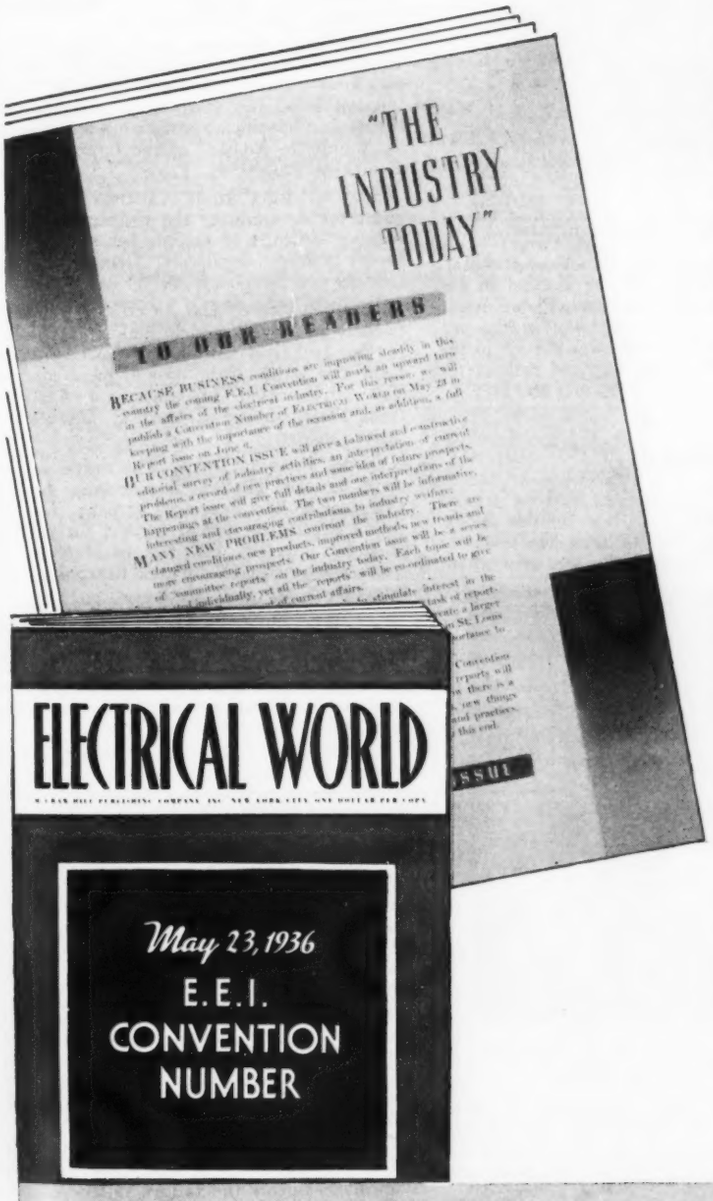

With the upturn of the electrical industry, many new problems have arisen that demand careful analysis and study in planning future action. It is most timely, therefore, that Electrical World's E. E. I. Convention Number will interpret the changed conditions, new practices, new products, new trends and encouraging prospects of "The Industry Today." Already, many leaders of the industry have evidenced interest in a preliminary prospectus of the data to be presented.

Announced to our readers . . . in advance

Advance interest is being created in this important issue through an eight-page editorial insert, appearing in the April 11th issue of Electrical World. It completely outlines the valuable editorial service that will be provided in the E.E.I. Convention Issue, and solicits the cooperation of the industry in preparaing it. (See sample pages at left).

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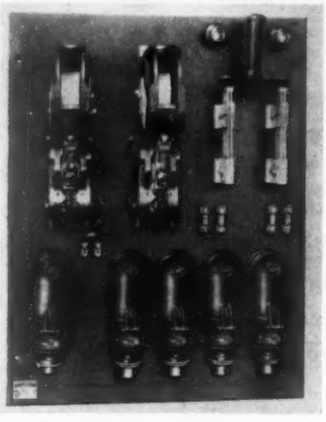
E. E. I. CONVENTION ISSUE OF ELECTRICAL WORLD—MAY 23rd

electronic control unit. Voltage from a d.c. pilot generator direct connected to the shaft of the controlled motor is applied through an adjustable potentiometer to the grid of a vacuum tube. Current in the tube circuit will vary with the d.c. voltage obtained from the pilot generator as motor speed departs from the potentiometer control speed setting. A relay in the tube circuit opens or closes as the current passes its critical value, thus actuating a high-speed rotary contactor that opens or closes two phases of the three-phase line of the motor.

•

Protective Panel for Cranes

All necessary protective devices for electrical equipment used on electrically operated cranes of the overhead traveling or locomotive type are mounted in this compact panel. Main line contactors, knife switches, pilot lights, instantaneous overload relays, inverse time element overload relays for



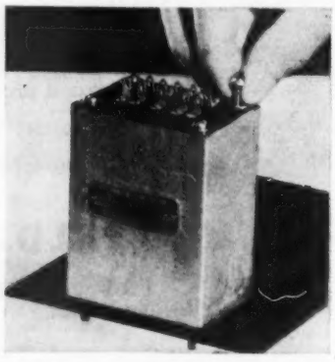
Electric Controller & Mfg. Co., Cleveland, Ohio

each motor and a separately mounted push button for closing the contactors or resetting them after operation are supplied. Two single-pole contactors are used for the main line and are closed in sequence, both are free to trip and will open immediately if overload exists while they are being closed or when the crane is operating.

•

Audio-Transformer

Each of the units of this new series of high-fidelity audio-transformers and reactors is said to have a frequency response of ±1 db. from 30 to 12,000 cycles. Self-shielding, core type construction renders the units

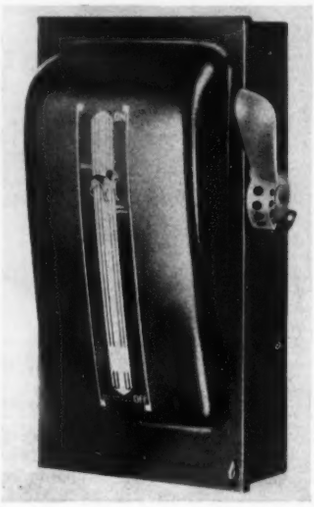


Mounted in completely reversible through-type case. **Ferranti Electric, Inc.,** New York City

free from hum and pickup, it is declared. In addition electrostatic shields are provided between windings in each unit. The units are designed for practically every use in the electronic field.

Safety Switch

Design of this switch differs from others in that the arc-extinguishing structure is on the blade rather than on the stationary contacts of the switch. Arc extinguisher is in the form of a stationary chamber, totally inclosed except for the slots at the bottom to receive the stationary contacts in separate



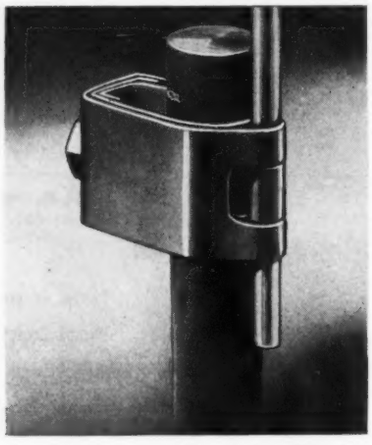
"Vacu-Break;" three types available, Master, Standard and Junior. **Bull Dog Electric Products Co.,** Detroit, Mich.

cells. Chamber houses the floating contact blade and it moves with the contact in and out on the stationary contacts. Piston action of the contacts when rupturing in the arcing chamber tends to evacuate the air in the inclosure, minimize burning and restrict the ionizable gas present to conduct the arc.

•

Ground Clamps

Greater grounding surface on both ground rod and conductor is claimed for this clamp. Copper strap is used to give resiliency or spring effect to assure a positive grip which



"Clamp-Tites;" made in two styles, for rod and pipe; variety of sizes available. **James R. Kearney Corp.,** St. Louis, Mo.

will not loosen under conditions of vibration, expansion or contraction. Quick installation or removal is possible even if the ground rod head has been flared out at the top.

•

Lamp and Fuse Tester

Farmet Corporation, New York City

Either plug or cartridge type fuses and all types of lamps may be quickly tested with this simple unit. Testing range is from a fraction to 500 amp.

ENGINEERING DATA FROM MANUFACTURERS

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MEASURING RADIO NOISE—A new E.E.I.-N.E.M.A.-R.M.A. joint publication (N.E.M.A. No. 102) sets up instrument specifications for measuring radio noise and procedure to be followed in use of such instruments. Subject matter is covered in five pages. Copies 35 cents, National Electrical Manufacturers Association, 155 East 44th Street, New York.

POWER TRANSFORMERS — Describes performance characteristics, insulation co-ordination, core and coil construction, cooling, painting, condenser bushing features, auxiliary device and testing facilities, 32 pages, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

LINE AND STATION POST INSULATORS—Electrical and mechanical performance of line and station post insulators for transmission lines and substations together with rating and specification data are in a twelve-page bulletin No. 123 of the Lapp Insulator Company, LeRoy, N. Y.

SETTING LINE DROP COMPENSATORS — A chart for determining the resistance and reactance settings of compensators used with feeder voltage regulators, General Electric Company, Schenectady, N. Y.

REFRIGERATION CALCULATOR — A small pocket-size device which makes it possible for non-technical salesmen to specify equipment and estimate the cost of most commercial refrigeration installations. Available from Westinghouse Electric & Manufacturing Company.

CRANE BEARING DATA—The crane supplement to the Timken Engineering Journal (Timken Roller Bearing Company, Canton, Ohio) illustrates typical layouts for the application of roller bearings to all types of crane machinery. Tabulated bearing recommendations are also given.

ELECTRIC FURNACE INSTALLATION recommendations are included in a 19-page booklet of the American Bridge Company, Frick Building, Pittsburgh, Pa. Typical installations are illustrated and a table of capacities, sizes and charging methods is given.

UNDERGROUND CABLE—Construction, specifications and installation and splicing recommendations applying to "Armortile" cable are covered in an eight-page booklet of the Hazard Insulated Wire Works, Wilkes-Barre, Pa.

DIESEL ENGINES—Construction features of direct injection, vertical four-cycle Diesel engines are covered in an eight-page pictorial folder (S-500-B 30) available from the Worthington Pump & Machinery Corporation, Harrison, N. J.

EROSION PREVENTION through use of "Debecote" paint on condenser tubes and other parts subject to wear by water in motion is covered in a twelve-page pamphlet entitled "Erosion." The Debevoise Company, 968 Grand Street, Brooklyn.

CABLE OPERATION—The 1934 report of the E.E.I. committee on transmission and distribution. Covers the failure rate of cables, joints and potheads at lowest levels. Publication C 11, price $1.50 to U. S. A. non-members.

ASBESTOS WIRE AND CABLE specifications and construction data are given in a 16-page catalogue being distributed by the National Electric Products Corporation, 1204 Fulton Building, Pittsburgh, Pa.

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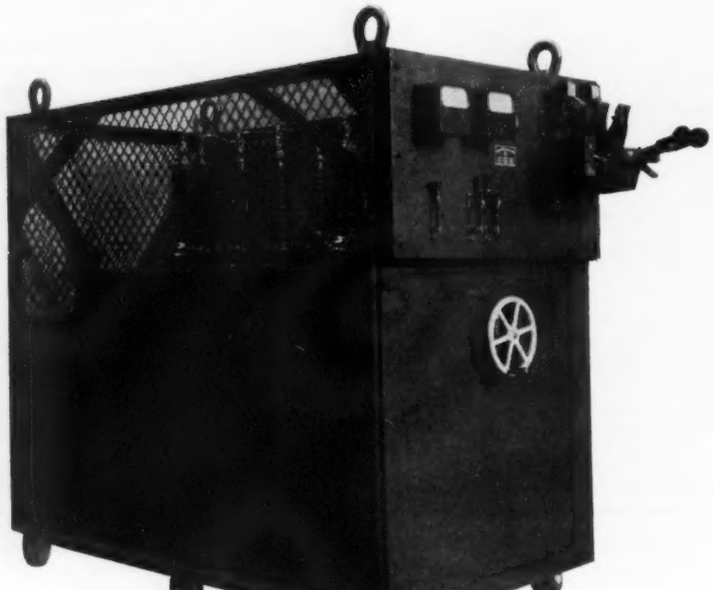
Heavy Duty
TESTING SETS *for*—UTILITY SERVICE



WHEN many of this country's largest utility companies and electrical manufacturers select one particular make of testing equipment, that apparatus must possess exceptional merit and be especially suited to the requirements.

AMERTRAN has specialized in supplying testing transformers and testing sets to utilities and large industrials for more than 34 years, and these units have come to be accepted as the "Standard of Excellence" for all types of service.

Illustrated is AMERTRAN Testing Set Type TS-10 which has been designed for commercial testing in laboratories of utility companies and cable manufacturers. It is extremely flexible and will furnish a maximum potential of 100,000 volts at 20 Kva.

May we send data on AMERTRAN'S complete line of testing sets?

AMER TRAN
TRANSFORMERS
Manufactured Since 1901 by—
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172 Emmet St. . . . . Newark, N. J.

Municipal Plants

PETOSKEY, MICH.—A reduction of 15 per cent in the rates of the municipally owned electric power plant has been ordered by the city, effective May 1. This cut will make the rates 60 per cent less than those in effect ten years ago.

CINCINNATI, OHIO—A. E. Morgan, chairman of the Tennessee Valley Authority, recently told a delegation of Cincinnati city officials that T.V.A. cannot supply the city with electric power within the next three years "because T.V.A. won't have it." He indicated, however, that power would be available for Cincinnati after that time when the power supply is augmented by additional T.V.A. dams. The conference was adjourned until the fall of 1937 or spring of 1938, by which time T.V.A. may be able to give a more definite answer to the overtures for purchase of T.V.A. power by the city. Chairman Morgan explained to the visitors that cities, towns and farms in the Tennessee Valley come first, and only after their needs have been met will the authority be able to send electricity outside the valley.

ALVA, OKLA.—At the election held on March 31 voters defeated the proposed issuance of the $255,000 in bonds, divided as follows: $240,000 municipal light and power plant and $15,000 water system improvement bonds.

CHATTANOOGA TENN.—Chattanooga Electric Power Board won a point in its litigation with the Tennessee Electric Power Company over the validity of the company's local franchise when Federal Judge George C. Taylor ordered the franchise suit remanded to State Chancery Court. The power company had sought to hold the case in federal court, to which it had been transferred last December by Chancellor J. Lon Foust, while the power board maintained that the suit should be decided by the chancellor. Judge Taylor held that his court was without jurisdiction in the litigation. The suit, brought under the Tennessee declaratory judgment act, seeks to have the validity of Tennessee Electric Power's local franchise settled.

Public power lawyers claim that the utility actually has no franchise. They assert that a franchise granted in 1888 to predecessors of the power company is void, because it violates the state constitutional provisions against perpetuities and monopolies, and that a later franchise has expired. Power company attorneys deny this. Because the company is chartered in another state, they asked the case be transferred to federal court, and Chancellor Foust granted their petition. Nothing has been decided so far except the matter of which court has jurisdiction. As it stands after the ruling by Judge Taylor, the case is back in Chancery Court. In the meantime, after a conference with Mayor E. D. Bass, Col. Harold C. Fiske, chairman of the Chattanooga Electric Power Board, said that "the Mayor and I see eye to eye" on the advisability of securing a written contract with the T.V.A. for furnishing the board power before the sale of $100,000 of bonds authorized recently by the city commission. W. F. Chamlee, general counsel of the board, has previously disclosed that he has entered into negotiations with T.V.A. for a contract for power.

Although the T.V.A. is prevented by an agreement with the Tennessee Electric Power Company from contracting for the sale of power in Chattanooga until 90 days after the completion of the power house at Norris Dam, Mr. Chamlee said that he can see no legal barrier that would prevent the T.V.A. from entering into a predated contract with the power board. At the city commission

meeting Mayor Bass said that he would not institute the sale of the bonds until a written contract had been secured with T.V.A. unless he were directed otherwise by the commission board.

MIDDLESBORO, KY.—City officials cannot erect a municipal light and power plant until the question is submitted to a vote of the residents and approved by them, Judge James M. Gilbert held in Bell Circuit Court. City officials want to construct a plant with government funds, but the question of their right has been in court more than a year.

MEMPHIS, TENN.—City has employed R. Husselman, consulting engineer, to design and supervise construction of a proposed municipal electrical system to distribute T.V.A. power. The Husselman contract, signed April 13 by the light and water commissioners, provides that survey and designing work is to start within 30 days.

KNOXVILLE, TENN.—City has been enjoined temporarily from using P.W.A. funds for building a municipal power system and from obtaining electricity from the T.V.A. The restraining order was granted by Chancellor A. E. Mitchell on a petition of the Tennessee Public Service Company. A former injunction suit, filed by the power company, was dismissed recently by the state supreme Court after the city had notified the court it was discarding its old P.W.A. and T.V.A. contracts and making new ones. Chancellor Mitchell issued the new injunction order when attorneys of the private utility gave notice of intention to file a bill attacking the new contracts. The chancellor required the power company to post $400,000 surety and set a hearing for April 28.

COLUMBIA, TENN.—Concerning reports that the city has authorized $350,000 bonds for a light plant and system, the City Recorder advises: "We are not contemplating the erection of a $350,000 plant. We are going to have an election June 25 on a loan and grant from the government (P.W.A.) for $204,000. We will not know until after that date just what steps will be taken."

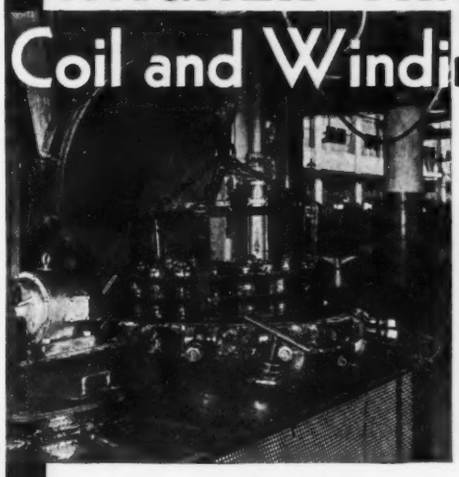
JACKSONVILLE, TEX.—Gross earnings of the municipal electric light and power plant during 1935 totaled $2,899,934 and its operating expenses were $1,031,496, leaving net earnings of $1,868,437, an official report reveals. Out of the net earnings it paid $62,525 interest on bonds, paid off $350,000 worth of bonds, transferred $1,039,275 to the city's general fund and paid a state utility tax of $40,121. The balance went to extensions and reserve.

WAYNESBORO, VA.—City Manager I. G. Vass made public a letter from David E. Lilienthal, T.V.A. director, dashing hopes that T.V.A. power eventually would be available to the city. The letter, in reply to a query from the city manager, said it is not believed that Waynesboro is within feasible transmission distance of T.V.A. dams, and that so far the T.V.A. board has made no plans for extending transmission lines into Virginia.

RICHLAND CENTER, WIS.—Installation of a 1,000-kw. turbine by the Richland Center Municipal Electric plant at a cost of $67,228, to be paid for from plant reserves, has been authorized by the Wisconsin Public Service Commission. The plant has agreed to supply an R.E.A. co-operative in Richland County with as much as 200 kw. on demand, and the new turbine will include provision for this load upon the plant.

DESHLER, OHIO—Patrons of the municipal light and water works received their bills on April 4, but each bill bore a notation: "Canceled with the compliments of

WAGNER TRANSFORMER
Coil and Winding Treatment



. . . facilitates the dissipation of heat . . . adds mechanical strength to the coils . . . retards the absorption of moisture in the coils . . . prolongs the life of the transformer.

Photo K1226—*Small transformer coils being removed from impregnating tank.*

THE latest methods are used in drying and treating Wagner distribution transformer coils. There are two types of treatment given, depending on the size and voltage.

THE windings of all small transformers which do not contain oil-ducts are impregnated with a solid copal gum compound by the vacuum-pressure process. The process consists of placing the coils in an impregnating tank where they are dried under vacuum at a temperature slightly above boiling. Then insulating compound is forced thru the coils under pressure, at the same temperature. The coils are then allowed to drain and bake before being removed from the tank.

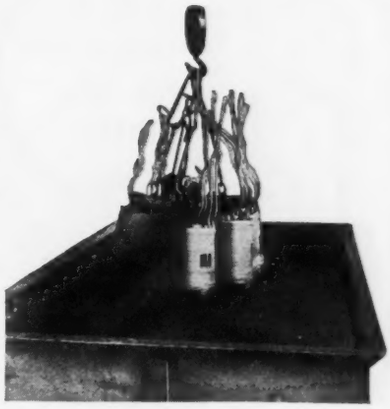


Photo K1225—*Dipping large transformer coils in special insulating varnish of high dielectric strength, the properties of the varnish are such that it remains semi-elastic after baking. Centrifugal separator underneath the varnish tank is in constant operation during the impregnation process, cleaning and removing moisture and foreign materials from the varnish.*

ALL windings that have oil ducts are treated differently. They are first dried in electrically-controlled ovens to remove all moisture, dipped in varnish, drained until the excess varnish has been removed, and then again thoroly baked — which process is repeated a number of times depending upon the voltage and kva rating of the windings.

Write for Bulletin 180 which completely describes Wagner Distribution Transformers.

Photo K1224—(*Left*) *Electrically controlled, gas-fired ovens in which transformer coils are dried and successive coats of insulating varnish are each baked on the coils.*

TD336-4B

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

TRANSFORMERS MOTORS FANS BRAKES

INDICATING
Cutout
ADVANTAGES

1
EASILY OBSERVED INDICATION OF BLOWN FUSE

2
FRONT REMAINS CLOSED

These features protect internal parts from the weather under all conditions and make it easy for a maintenance man to detect a blown fuse. Another advantage of the Westinghouse indicating type cutout is that both ends of the fuse tube are removed from the live contacts when the positive acting indicator operates. This eliminates leakage across the fuse tube and consequent failure.

Request complete information today. J 60009

WESTINGHOUSE 1886 1936 GOLDEN JUBILEE

Westinghouse

the Board of Trustees of Public Affairs." Frank B. Miller, superintendent of the city utilities, said the bills were canceled because the plant "just had too much money." "Some day we might need more, so instead of reducing rates for lights and water we just mark the current bills paid when our reserve fund is ample," he explained. The "dividend" amounted to $3,200, approximately $2 for each of the village's 1,600 inhabitants. During 1935, Mr. Miller said, patrons received $7,800 in canceled bills, representing monthly statements for March, June and November.

•

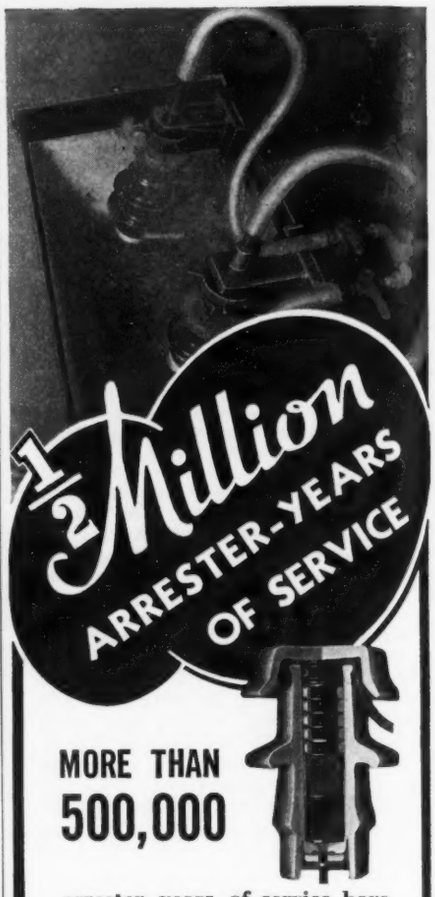
Recent Rate Changes

MEMPHIS POWER & LIGHT COMPANY has filed an answer to the Tennessee Railroad and Public Utilities Commission's order to show cause why electrical rates should not be reduced (ELECTRICAL WORLD, April 4, page 11). The commission order to be fought by city officials in an effort to keep the power company from establishing electrical rates low enough to compete with T.V.A. municipal rates, was answered briefly by the power company, which neither objected to the reduction nor opposed it. "This respondent," the answer said, "files with this honorable commission monthly reports which accurately and truthfully reflect its operating results, and respondent herein incorporates, by reference, said operating reports as a part of this, its answer. Respondent asks that a hearing be held on said matters and any other relevant evidence that may be offered by it as to whether there should at present be any readjustment of its rates."

LAWRENCE GAS & ELECTRIC COMPANY rate hearings have been resumed before the Massachusetts Department of Public Utilities. Counsel for the company told the commission that flood loss to the company was more than $100,000 and may reach $200,000. This will come out of capital, he said, but will be charged to earnings.

NORTH DAKOTA STATE BOARD OF RAILROAD COMMISSIONERS has announced new residential, water heating and industrial power electric rates for five companies. At Williston a new optional residential rate was approved by the board for the Montana-Dakota Utilities Company. The rate is retroactive to March 1. The new rates and comparisons at Williston are: First 100 kw.-hr. per month 8½ cents per kilowatt-hour, formerly 9 cents; next 100 kw.-hr., 8 cents, formerly included a 200-kw.-hr. step; next 300 kw.-hr., 5 cents per kilowatt-hour, formerly 7 cents; more than 500 kw.-hr. per month, 4 cents, formerly 6 cents. The minimum bill remains $1. For the first time a special water heating rate of $1.50 per kilowatt-hour during stated hours was placed in effect by the Central Light & Power Company in twelve communities, with the approval of the commission. A reduction of 50 per cent of the minimum charge on power rates for grain elevators and feed mill motors was approved by the commission for the Northern States Power Company at Minot, the Union Light, Heat & Power Company at Fargo and the Red River Power Company at Grand Forks.

PUBLIC SERVICE COMMISSION OF LOUISIANA has recently released a summary statement which tabulates for the information of the people in that state the rate reductions which were put into effect through the activities and regulation of that commission in the nine months' period from December 1, 1934, to September 1, 1935. In the period mentioned the commission initiated and brought to a successful conclusion ten formal cases in which rates were reduced in the aggregate $1,482,050 per annum.



MORE THAN
500,000

arrester years of service have proved conclusively that Westinghouse LV arresters are moisture-proof. Since the all-seal construction was adopted, only two cases of trouble have been reported.

Every arrester is tested under water at the factory to assure moisture-proof operation in service. Air at 25 pounds per square inch pressure is applied to the arrester. Tell-tale bubbles of air mean rejection.

Check these other features.

- Withstand 50,000 ampere surges—more than double previous designs.
- Long life because abnormal system voltage cannot cause unnecessary arrester mortality.
- Drop-out feature prevents line grounding if arrester is destroyed.
- Every porous block of every arrester is given a surge test to assure correct operation.
- Blue-gray color to facilitate distinguishing from old arresters. J 60005

Westinghouse
New
WESTINGHOUSE 1886 1936 GOLDEN JUBILEE
LV ARRESTERS

Please, Mr. Lilienthal

[*Continued from page 41*]

were about $300,000 greater in the benighted year of 1930, before he came along.

"Residential rates were reduced again in 1933 (no T.V.A. then), and they were reduced very materially in January, 1934. Even at that late date the T.V.A. hadn't begun serving a single community, and it hadn't announced any rate schedule. And, most emphatically, our new low rates were not established by reason of any agreement with the T.V.A.

"If a touch of reality is not out of place, we suggest that the T.V.A. has invented nothing new in the electric business. We suggest that Mr. Lilienthal has merely adopted those sound operating methods and sales policies evolved by the private industry through years of experiment, through a long process of trial and error, through a willingness to take risks by adopting new ideas. It is always that way with government in business.

"Please, Mr. Lilienthal, don't teach your grandmother to spin."

•

France Sets Up Council For Regulating Power

France recently set up a super-regulatory body to direct the country's future power development, the Conseil Superieure de l'Electricite. It will rule on all public restrictions on generation and transmission; approve or deny requests for concessions; fix dates for starting work on hydro-electric concessions; allocate financial assistance when granted, and determine rates.

On this council, in addition to representatives of a long list of government departments, are included 25 consumers' representatives, 25 for the power companies and several for departmental and municipal governments, the coal industry, the metallurgical industry and appliance manufacturers.

•

Gatineau to Expand

Plans for adding a 10,000-hp. turbo-generator steam unit at Dalhousie to supplement the big Grand Falls, N. B., hydro development are announced by Gatineau Power Company.

•

Cables Now Labeled

A new "Underwriters' Laboratories' Inspected" label is now available for approved gas tube sign and oil burner ignition cable following issuance of the new standard on February 7.

PREEMINENT
for GROUND TESTING!

"WE have found that the 'Meg' Ground Tester far surpasses our expectations. In fact, we can hardly believe how such accurate results are obtained . . . ."

From a Power Company in Pennsylvania.

NOW IS THE TIME to start your ground testing program for the 1936 season. "Megger" and "Meg" Ground Testers are THE instruments for the purpose. Please write for our new descriptive Catalog 1425-W.

JAMES G. BIDDLE CO.
ELECTRICAL INSTRUMENTS
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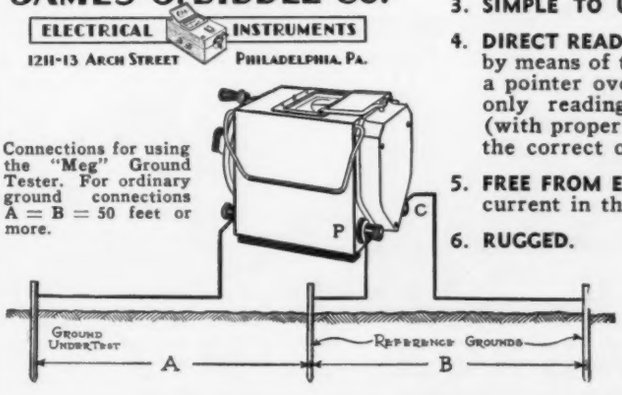

Connections for using the "Meg" Ground Tester. For ordinary ground connections A = B = 50 feet or more.

"MEG"
GROUND TESTER
for measuring resistance to earth of ground connections.

1. **SMALL SIZE**—Aluminum case 5"x9¼"x6¼" high.
2. **LIGHT WEIGHT** — Weighs about 8 pounds.
3. **SIMPLE TO USE**—See below.
4. **DIRECT READING IN OHMS**—by means of the deflection of a pointer over a scale. The only reading you can get (with proper connections) is the correct one.
5. **FREE FROM EFFECTS** of stray current in the earth.
6. **RUGGED.**

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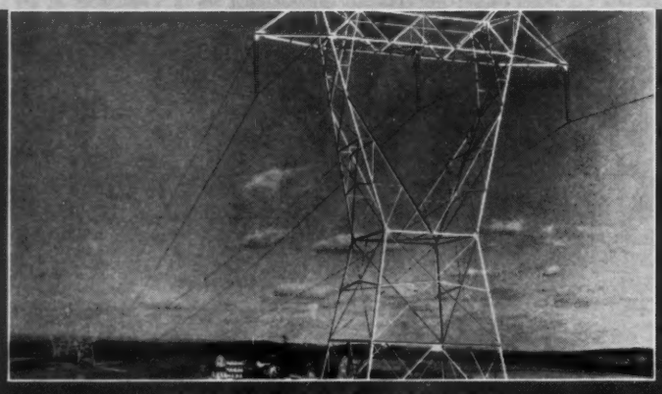

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Thousands of miles of transmission towers . . . structural work necessitating highly specialized fabrication . . . enormous areas of Electroforged open flooring . . . standard steel buildings for all uses . . . gas cleaners for natural gas lines . . . steel forms for concrete tunnels, walls, etc. . . . steam purifiers, desuperheaters . . . clamshell buckets . . . and other products of Blaw-Knox manufacture are at work for the Public Utilities of America.

The fact that Blaw-Knox Products are in accord with the rigid standards of Public Utility purchasing is proof not only of the merit of the products themselves but of the house behind the products.

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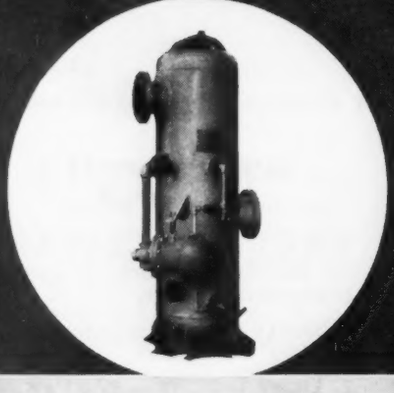
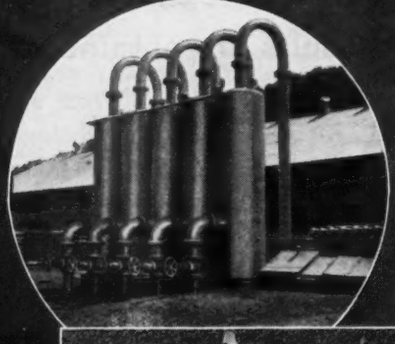


GAS CLEANERS



STEEL BUILDINGS

CLAMSHELL BUCKETS

BLAW-KNOX COMPANY

2013 FARMERS BANK BUILDING, PITTSBURGH, PA.

SALES OPPORTUNITIES IN NEW CONSTRUCTION

GLENCOE, MINN.—McLeod Co-operative Power Association, Walter Jungelaus, secretary, recently organized, is completing plans for new transmission and distributing lines for rural electrification in different parts of McLeod County, totaling 600 miles, with service facilities. Fund of $650,000 has been secured through Federal aid.

MOUNT VERNON, MO.—State Building Commission, Capitol Building, Jefferson City, Mo., Edgar M. Eagan, executive secretary, receives bids until May 12 for engine and generator units, with accessories, boilers, stokers and auxiliary equipment for power plant at institution at Mount Vernon. Cost about $200,000. Baumes-McDevitt Company, Railway Exchange Building, and Ralf Toensfeldt, Security Building, both St. Louis, Mo., are consulting engineers. Bids will be received, also, at some time for similar equipment for new power plant at State Hospital No. 1, Fulton, Mo., estimated to cost about $350,000. Same engineers noted in charge. Charles A. Haskins, Finance Building, Kansas City, Mo., is general supervising engineer.

MILAN, GA.—Georgia Power Company, Atlanta, is considering new transmission line to Milan and vicinity for local service. Company has approved plans for new 110,000-volt outdoor power substation at Tifton, Ga., to connect with new transmission line now in course of construction from Americus to Tifton, and will begin work on station at once, to occupy area 150x150 feet. Extensions will be made in distributing lines at Tifton and vicinity.

WASHINGTON, D. C.—United States Engineer Office, Navy Department, Washington, receives bids until April 29 for two motor-generator sets (Circular 72).

SPRINGFIELD, OHIO—Crowell Publishing Company plans installation of motors and controls, conveyors and other equipment in connection with expansion and improvements in printing and publishing plant. Work will be carried out over a period of months. Cost about $1,000,000.

DAVENPORT, IOWA—Scott Rural Electric Co-Operative Association is completing plans for new rural electrification program in different parts of county, including transmission and distributing lines, with service facilities. Fund of $260,000 has been secured through Federal aid.

FORT WAYNE, IND.—Peter Eckrich & Sons, 1025 Osage Street, meat packers, plans installation of motors and controls, conveyors, electric hoists, etc., in new addition to plant, 200x300 feet. Cost about $125,000.

PITTSBURGH, PA. — Duquesne Light Company plans new transmission line across Allegheny River, vicinity of Herrs Island. Federal permission has been asked.

PORTSMOUTH, N. H.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until April 28 for one motor-generator set with control panel and accessories for Portsmouth Navy Yard (Schedule 7665).

BEAUFORT, S. C.—General Phosphate Company, care of Charles V. Boykin, 5 King Street, Charleston, S. C., recently organized by Mr. Boykin and associates, plans installation of motors and controls, conveyors, electric hoists, transformers and other equipment in new grinding and milling plant at Beaufort for phosphate production for agricultural service. Also similar equipment for mining operations at phosphate rock properties. Entire project will cost close to $500,000.

ROCK RAPIDS, IOWA—Soon takes bids

for 100-kw. generator unit with accessories, boilers and other equipment for city-owned power plant. Cost about $200,000. Financing has been arranged. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

SAN HAVEN, N. D.—State Board of Administration, Capitol Building, Bismarck, N. D., receives bids until April 30 for equipment for power plant at state institution at San Haven. Fund of $300,000 has been arranged for this and new infirmary building. William F. Kurke, 1117 Thirteenth Avenue North, Fargo, N. D., is architect.

FORT PECK, MONT.—United States Engineer Office, Postal Telegraph Building, Kansas City, Mo., receives bids until May 21 for gate shafts for tunnels at Fort Peck, including tunnel power substation with equipment, electrical installation complete for tunnel emergency gates, and for temporary electrical distribution system (Circular 29).

OMAHA, NEB.—Nebraska Power Company plans improvements in steam division at electric generating plant, including installation of new high-pressure boiler unit and accessories. Cost about $75,000. Plans also under way for new power substation, estimated to cost about $65,000, with equipment.

NEW YORK, N. Y. — Continental Can Company, 100 East Forty-second Street, plans installation of heavy-duty and other electric motors, controls, regulators, conveyors and other equipment in expansion and improvement projects at different plants throughout the country, including Baltimore, Md., Wheeling, W. Va., Memphis, Tenn., Houston, Tex., Chicago, Ill., Seattle, Wash., Syracuse, N. Y., Montreal, Que., Toronto, Ont., and other points. Fund of about $6,000,000 has been arranged for entire program.

BROOKLYN, N. Y.—Signal Corps Procurement District, Army Base, Brooklyn, receives bids until May 8 for 125 motors and 100 power units (Circular 188).

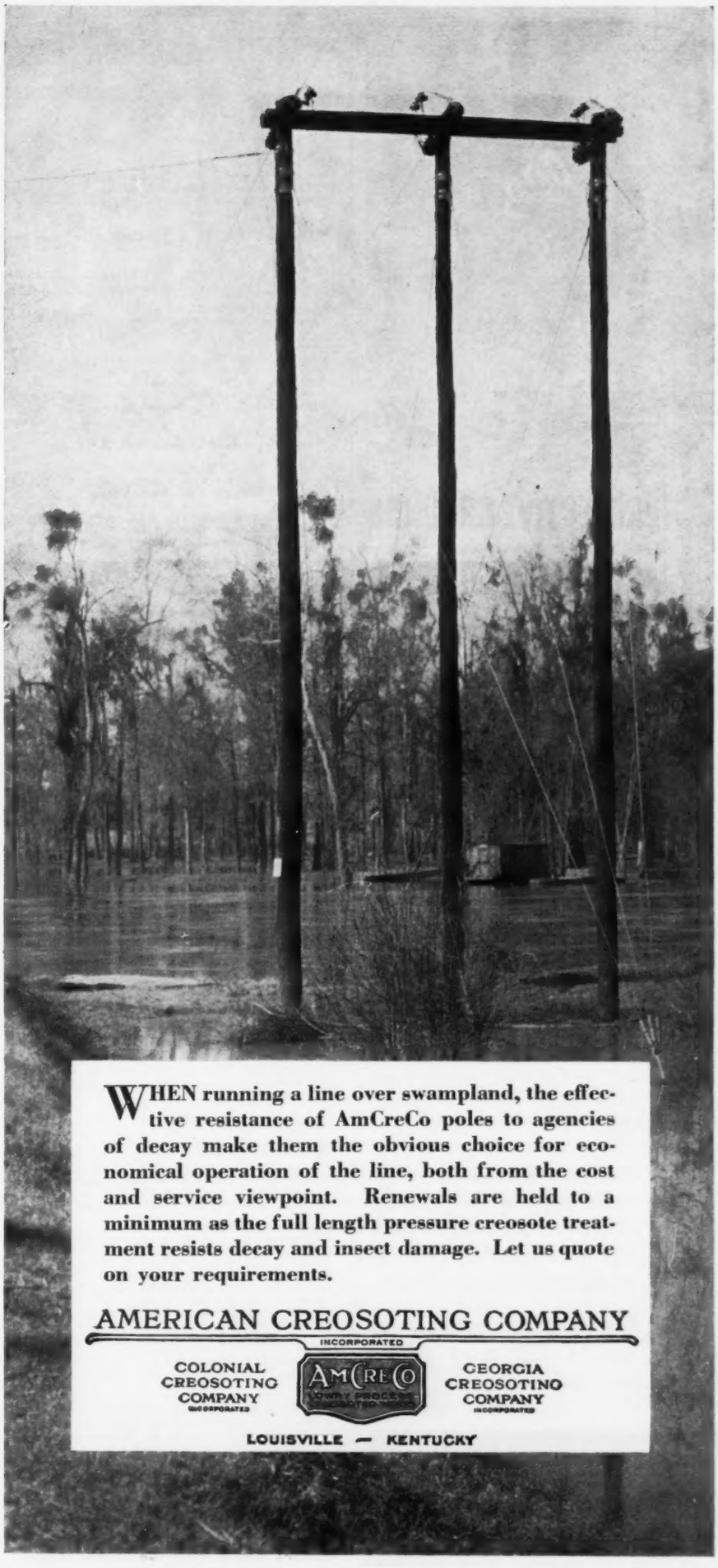
PALATKA, FLA.—Has engaged Burns & McDonald Engineering Company, 107 West Linwood Boulevard, Kansas City, Mo., consulting engineer, to make surveys and estimates of cost for proposed city-owned electric power plant and distributing lines.

NORTH PLATTE, NEB.—Platte Valley Public Power and Irrigation District, North Platte, has secured permission to construct new transmission lines from North Platte generating station to McCook and to Columbus, Neb., respectively, totaling about 300 miles, to include power substations, switching stations and other operating facilities. Financing will be arranged. D. D. Price, North Platte, is chief engineer and general manager; Parsons, Klapp, Brinckerhoff & Douglas, 142 Maiden Lane, New York, N. Y., are consulting engineers.

SAN DIEGO, CALIF.—Bureau of Supplies and Accounts, Navy Department, Washington, D. C., receives bids until May 5 for 18 10-kva. transformers and spare parts for San Diego Navy Yard (Schedule 7704).

CHICAGO, ILL.—Great Western Steel Company, 2300 West Fifty-eighth Street, plans installation of electric hoists, conveyors, motors and controls, and other equipment in new one-story addition, 122x170 feet. Cost close to $100,000, with machinery. Permit has been issued. F. C. Folten, 38 South Dearborn Street, is architect.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until May 18 for four 55,000-kva., 60-cycle, single-phase, water-cooled transformers, 16,400-volt to 132,950/230,000 volts, for Boulder power plant, Boulder Canyon Project, Arizona-California-Nevada. Installation will be made by Government (Specifications 680).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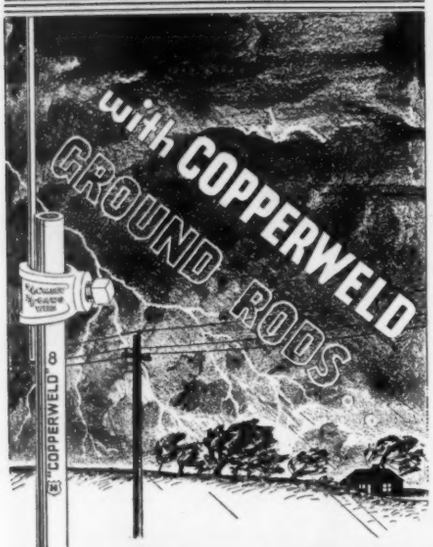

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Chance Company, Centralia, Mo.
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General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kennecott Wire & Cable Co., Phillipsdale, R. I.
Okonite-Callender Cable Co., Passaic, N. J.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.

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Anaconda Wire & Cable Co., New York, N. Y.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
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Indiana Steel & Wire Co., Muncie, Ind.
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Anaconda Wire & Cable Co., New York, N. Y.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
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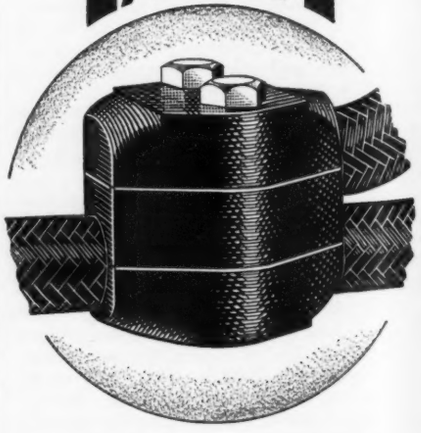

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